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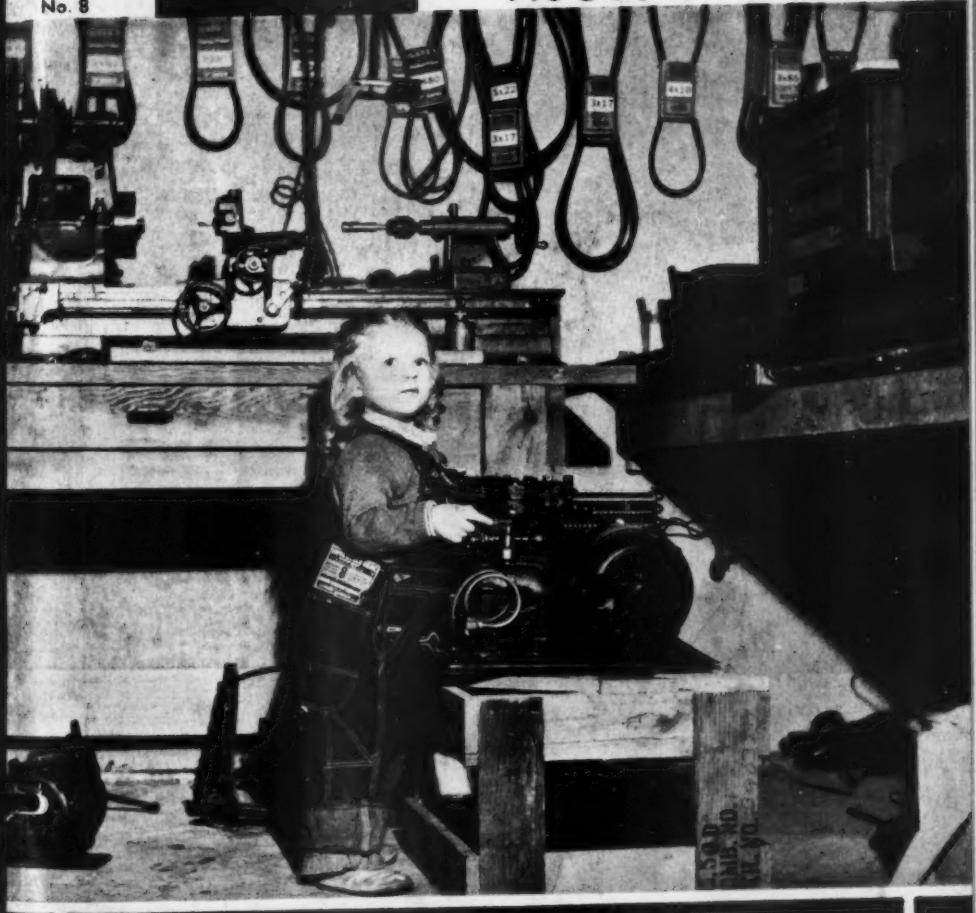

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August, 1940

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Official Organ
REFRIGERATION SERVICE ENGINEERS SOCIETY

Cover

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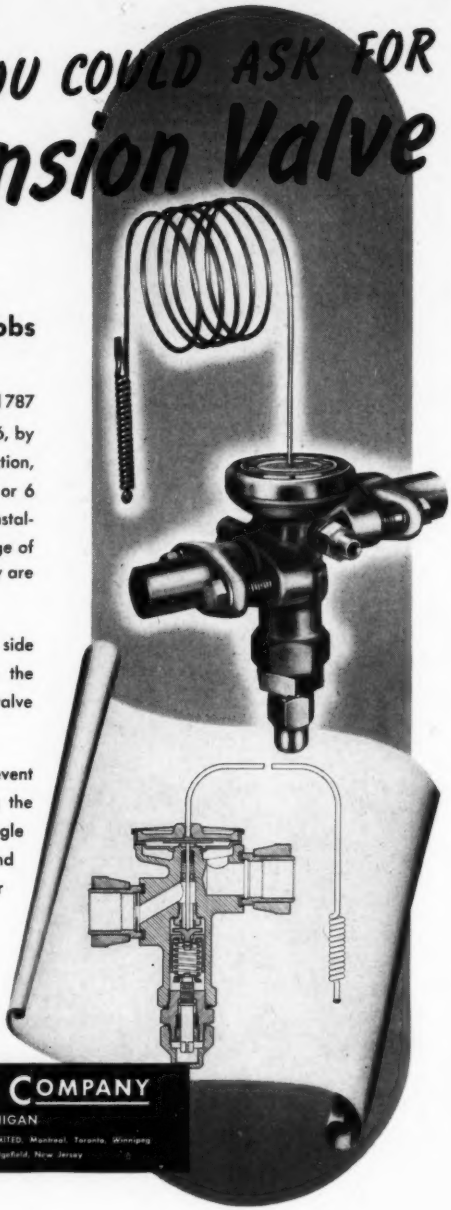

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Thermostatically Controlled Expansion Valves

By A. F. HOESEL*

MANY service men believe that when they purchase a thermostatically controlled expansion valve which has been factory adjusted to, say, 10 degrees F. superheat setting, such valve will operate to maintain this preadjusted superheat setting under a wide variation of coil temperatures. This is not true of diaphragm type valves, which have a thermostatic charge of the same refrigerant as used in the refrigerating system, and such valves are usually so charged.

Many of you have come across the fact that certain jobs, right after installation, or a start up after a long shut-down period, will seemingly flood back refrigerant liquid to the compressor for quite some time before the thermal expansion valve starts to throttle the refrigerant flow through the cooling unit. To some, who are unacquainted with the characteristics of these valves, it appears that the valves have not been properly adjusted. This is not always true, as can be noted further.

All diaphragm type thermal expansion valves, having the same thermostatic charge as used in the refrigerating system, irrespective whether using sulphur dioxide, methyl chloride, or Freon, and irrespective of whether such thermal expansion valve has a liquid, semi-liquid, vapor, or gas charge, operate with increasing superheat on the lowering of the refrigerant temperature.

All such valves further operate with decreasing superheat on the raising of the refrigerant temperature, but the gas charged valve has a certain definite limit, in this respect, namely, at the flash off point of the thermostatic charge which must necessarily be higher than the usual operating temperatures.

The conventional thermal expansion valve operates by means of three forces. The first force is the refrigerant pressure, within the cooling unit, acting under the diaphragm and tending to allow the valve to close off. The second force is the pressure of the thermostatic fluid, within the temperature feeler bulb, acting upon the top of the diaphragm and tending to open the valve. The third force is that of a spring acting upon the under side of the diaphragm and assisting the first force.

The amount of the spring force is adjustable so that the thermal expansion valve may be adjusted for a given degree of superheat at some operating temperature, but, in the types of valves under discussion, such super-

* Flow Controls, Inc., Chicago, Ill.

heat adjustment does not hold true for even a comparatively narrow range of refrigerant temperature variation.

In Fig. 1, I graphically show the variation of superheat, incident to lowering and rising temperatures of the refrigerant.

The full line shows the superheat variation, between minus 20 degrees F. to plus 80 degrees F. refrigerant temperature, in a cooling unit fed with a thermal expansion valve, which has been adjusted to maintain a 10 degree F. superheat at 30 degrees F. refrigerant temperature. Note that the line crosses the 10 degree F. superheat at the 30 degree F. refrigerant temperature.

The dotted line shows the superheat variation, between minus 20 degrees F. to plus 80 degrees F. refrigerant temperature, in a cooling unit fed with a thermal expansion valve, which has been adjusted to maintain a 10 degree F. superheat at 0 degree F. refrigerant temperature. Note that the line crosses the 10 degree F. superheat at the 0 degree F. refrigerant temperature.

The dash and dot line shows the superheat variation, between minus 20 degrees F. to plus 80 degrees F. refrigerant temperature, in a cooling unit fed with a thermal expansion valve, which has been adjusted to maintain a 10 degree F. superheat at minus 20 degrees F. refrigerant temperature. Note that the line crosses the 10 degree F. superheat at minus 20 degrees F. refrigerant temperature.

You might question this chart as not being equally applicable to sulphur dioxide, methyl chloride, and Freon thermal expansion valves, but I can assure you that such is the case. The limits of accuracy, as between the different refrigerants, are within plus or minus one degree F., which is sufficiently accurate for the present purpose.

No doubt many of you might wonder as to why this variation occurs. If, every time that a refrigerant liquid were increased in temperature some definite amount, there would be an equal increase in pressure, this phenomenon would not occur and the thermal expansion valve would then carry a constant superheat throughout any range of refrigerant temperature.

Assume a Freon thermal expansion valve adjusted to carry a 10 degree F. superheat at minus 20 degree F. refrigerant temperature. Consulting the Freon thermodynamic tables, we find that the refrigerant pressure, in the cooling unit, at minus 20 degree F., would be .58 lbs. gauge. Since the valve is adjusted to carry 10 degrees F. superheat, the Freon thermostatic charge, in the temperature feeler bulb, will be at a temperature of minus 10 degrees F., and the pressure, in the temperature feeler bulb and on top of the diaphragm, tending to open the valve will be 4.5 lbs. gauge. The force of the spring, necessary to balance at this 10 degrees F. superheat, will have to be 4.5 minus .58 = 3.92 lbs. for every square inch effective area of the diaphragm.

If the refrigerant temperature in the cooling unit reaches 30 degrees F. then its pressure will be 28.46 lbs. gauge. 28.46 lbs. plus 3.92 lbs. spring pressure = 32.38 lbs. balancing pressure necessary in the temperature feeler bulb and on top of the diaphragm to open the valve. Consulting the thermodynamic tables, we find that 32.38 lbs. gauge = 34.6 degrees F. The superheat is

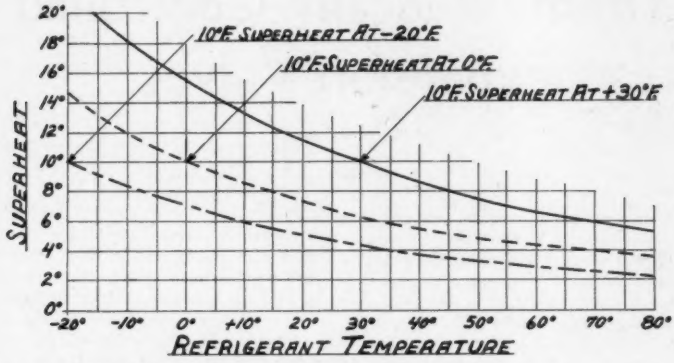


Fig. 1. Showing graphically the variation in superheat of thermostatically controlled expansion valves.

34.6 degrees F. minus 30 degrees F. = 4.6 degrees F. Consulting Fig. 1, gives the same answer without the laborious calculations.

To some extent, this variation in superheat tends to make a system flood back under the higher temperatures, as mentioned before, but this can be remedied, or at least greatly minimized, by employing valves with the proper sized orifices, having a flow capacity, under the particular operating conditions, not greatly in excess of the normal requirements. It is indeed surprising what can be accomplished by proper orifice sizing.

To be continued

Third Article *(Concluded)*

High and Low Side Float Systems*

The third and last article of this series presents a thorough discussion of service operations on the high side float. Illustrations referred to with the exception of Fig. 14 and 15, appeared in the July issue.

A STUDY of the construction of floats indicates that the possibility of mechanical trouble with the float is very remote. Most failures are traceable to other characteristics that directly affect the operation of the float. There are only three characteristics that result in actual failure of the float to function.

(1) Friction of the actuating levers and pins resulting from foreign substances or corrosion, caused by moisture in the system. Agitation of any foreign substance in the chamber may cause the valve orifice to plug.

(2) The valve seat may leak due to erosion or cutting by foreign substances lodging between the needle and valve seat.

(3) The float ball may fill with liquid or collapse, thus losing its buoyancy and failing to open when additional liquid enters the chamber. In most cases this condition is brought about by extremely high pressure in the condenser and float chamber. This excessive pressure can be traceable to noncondensable gases in the condenser tubing, oil slugging or in combination with stoppage of refrigerant flow from the chamber.

There are several other characteristics that may indicate float failure, where if the proper analyses are made and remedies applied, the float would function normally. It is important to recognize the following symptoms as they may indicate float trouble and eliminate the unnecessary procedure of changing the float assembly only to find the same difficulty remaining.

1. Inadequate Refrigerant Charge. If the refrigerant charge is under the minimum quantity to wet all the evaporator surface, rapid change in condensing temperature may cause sufficient refrigerant liquid to stay in the condenser and not drain into the float chamber. Should this occur the compressor will pump out the low side and the symptoms are similar to stuck shut float, collapsed or sunk float ball, clogged orifice or frozen feed line due to moisture in the refrigerant. When a system is short charged to a critical point the compressor may reduce the suction pressure so rapidly at the beginning of the cycle that oil will slug over into the float. This will temporarily increase the volume in the float, and may even give satisfactory refrigeration for some time. The oil will remain in the low side and eventually the unit will have the symptoms of a stuck shut float.

A compressor will slug oil only by a rapid reduction of pressure in the crankcase. This can happen only by deliberately closing the suction service valve or by no refrigerant in the system. When the system is very short of refrigerant, the oil level in the crankcase will be low.

2. Slight Overcharge of Refrigerant. This condition permits the compressor crankcase to operate at lower than normal temperatures. If the oil in the crankcase is comparatively cool, a greater percentage of refrigerant will go into solution with the oil on the off cycle. When the compressor starts at the beginning of the cycle the suction pressure reduction is faster than later on in the cycle. If the oil becomes nearly saturated

*Courtesy of the Kelvinator Division, Nash-Kelvinator Corp.

at the cut-in pressure, any reduction lowers the quantity of refrigerant that can stay in the oil. The compressor slugs oil over into the condenser adding to the volume of liquid in the high side. Since the only liquid that can stay in the high side is sufficient to float the ball, the ball raises farther and floods more refrigerant into the crankcase. This symptom appears as a stuck open float.

It should be remembered that when the charge is correct a leaky or stuck open float will not flood the crankcase. The accumulator acts as a reservoir for the slight amount of liquid between the normal level in the float and the level to which it may lower to uncover the valve orifice. Actual tests with floats leaking badly enough to balance the high and low pressure in five minutes after the unit stopped, did not pull liquid over into the crankcase.

3. Failure of the water regulating valve on water cooled systems to maintain fairly constant outlet temperatures or surging of the water valve, may cool off the condenser sufficiently fast to reduce the pressure difference between the condenser and the float chamber so that all the liquid will stay in the condenser. This symptom will indicate erratic float action or stuck shut float.

4. Air or other non-condensable gases in the system will ultimately collect in the top of the float chamber. This condition will result in a higher than normal pressure in the condenser to force the liquid into the float. The condenser will have to partially fill with liquid to raise the pressure. The low side will be starved by the amount that stays in the condenser. On air cooled systems short of refrigerant, the condenser may hold all of the charge and on water cooled floats the system may pump down with a full charge of refrigerant.

Caution

Before attempting to analyse the trouble on any high side float system, be sure that the refrigerant charge is normal and all non-condensable gases are removed from the condenser and float chamber.

Refrigerant Charge

For successful operation, all the surface in the evaporator must be wet with liquid with some liquid spilled over into the accumulator. The charge specified by the factory for unit systems will satisfy this condition. When a system is empty of refrigerant the most practical way to obtain the correct charge, is to completely evacuate the system and weigh in the factory charge. There is chance of an error in weighing in refrigerant on a service call. This is due to the physical limitations of the equipment available. Therefore, when this method is used make certain that the connecting tube to the cylinder does not interfere with accurate weight and that no appreciable weight of refrigerant is lost when disconnecting the connecting tube.

Checking the Charge

To check the charge in an operating system other than room coolers, the following conditions must prevail. (1) The suction pressure must be below the cut-in pressure temperature for the particular system. For example, a Freon-12 beverage cooler or water cooler, 34 lbs., a Freon-12 ice cream cabinet, 20 lbs. a SO_2 household refrigerator, 6 lbs.

(2) The head load on the evaporator must be near normal or such that will keep the unit operating a sufficient length of time to check the charge. For example, the evaporator coil on a wet type beverage cooler must be covered with water. A slight flow of water must pass through a water cooler, a tray of water starts to freeze in a household refrigerator evaporator. (3) The refrigerant must be added if possible during one on-cycle of operation.

By referring to the refrigerant cycles (Figs. 6 to 13), the letters A, B and C appear on all evaporators. Let us assume that a Freon-12 ice cream cabinet, illustrated in Fig. 7, has a short charge so that the evaporator is wet with liquid to the point "A"; the compressor operating with a suction pressure of 20 lbs. If we attach a Freon-12 cylinder to the suction service valve with a gauge in the connecting line and open the cylinder valve to admit vapor, thereby adding refrigerant to the low side, we will increase the amount of surface wet with liquid so that the liquid will reach point "B." This will raise the suction pressure above the 20 lbs. first observed. Now assume we continue to add vapor from the cylinder intermittently and observe the gauge between each addition, this will continue to raise the suction pressure at each operation until the liquid reaches point "C." The reason for the pressure rise is that more surface is wet with liquid and more refrigerant is vaporized. When the liquid reaches point "C," any additional refrigerant added will spill over into the accumulator and will effect no

change in suction pressure. At this point we have the minimum charge for the system. The factory charge contemplates filling the accumulator at least one-third full of liquid. When point "C" is reached add a slight additional quantity of refrigerant. Continue to add refrigerant and the accumulator will be filled and begin to spill liquid over into the suction line. At this point the system is overcharged on systems with a heat exchanger coil in the float chamber as illustrated in Fig. 7; any liquid pulled out of the accumulator into this coil will immediately reduce the head pressure from 5 to 15 lbs., depending upon how much liquid enters the coil. The suction gauge will also drift over a two to four lb. range as the liquid flashes off to vapor in the heat exchanger coil. If this condition exists, purge slightly until the head pressure rises back to normal and the suction gauge is stable. On the other type systems a slight over charge will pull over into the suction line and if a suction line to liquid line heat exchanger is used, the liquid will be subcooled by evaporation and nothing will be gained from the heat exchanger.

When a system has been operating with a short charge, the oil level will be low in the compressor, the oil trapped into the evaporator. By adding refrigerant until a spill over into the accumulator occurs, the oil will start to return to the compressor. When the oil level is low in the compressor, add refrigerant as described and the oil will return to the crankcase. When point "C" is reached by following the above procedure, permit the unit to operate 10 to 15 minutes for Freon-12, 15 to 20 minutes for methyl chloride and 20 to 30 minutes for SO_2 systems. This gives time for the oil to return to the crankcase, then mark the final observation as to suction line temperature, head pressure, et cetera.

When adding refrigerant to a high side float system never try to force the refrigerant from the cylinder into the high side, always admit vapor through the suction service valve. The cylinder should be warm enough that the pressure in the cylinder is at least 20 lbs. above the pressure in the low side so that when the cylinder valve is opened, the refrigerant will enter rapidly and then the cylinder valve shut off for suction pressure observation.

Refrigerant Charged Room Cooler Floats

All room coolers operate at suction temperatures above 32 degrees and the load is constant only over long periods of time. For this reason the procedure previously outlined is not practical for evaporators with high loading per unit of surface. The float used on room coolers are of two types, one with heat exchanger coil in the float, the other a single float in the chamber. The method of charging is by the superheat of the suction gas leaving the accumulator. The thermometer and bulb location must be such that it will read the superheat before the suction gas enters the heat exchanger. The two thermometer bulb locations, as illustrated in Figs. 14 and 15, are typical for the two types of float.

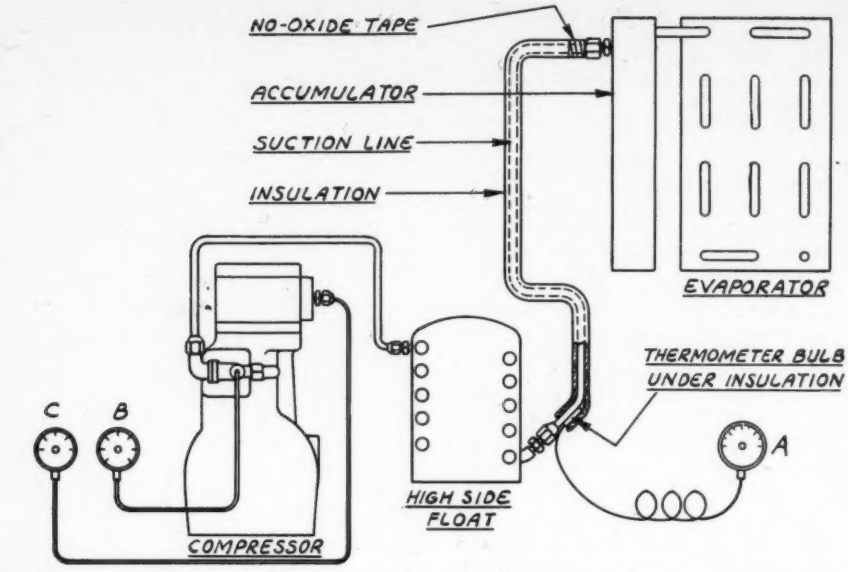
Checking the Superheat

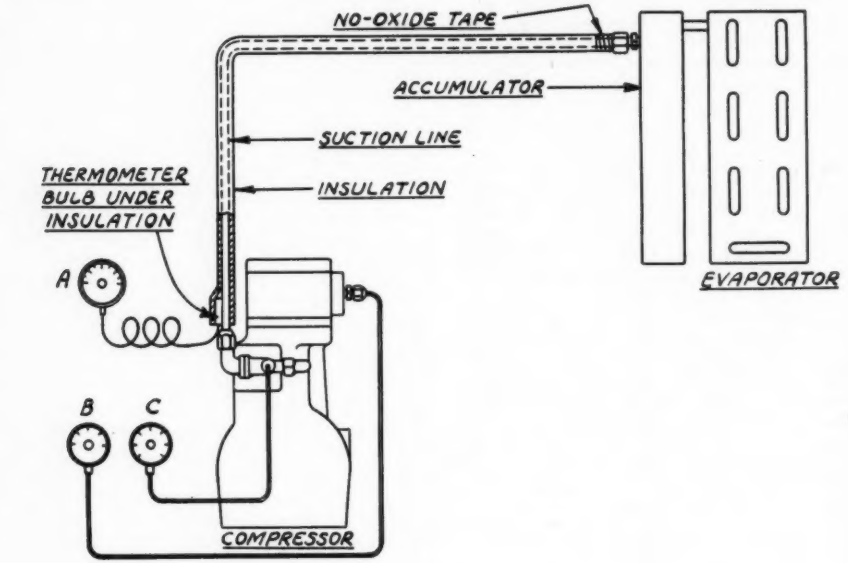
To check the charge by the superheat method, the unit must be in operation a sufficient length of time for all pressures to reach equilibrium. The wet bulb temperature of the air passing over the evaporator surface must be at least 68 degrees or above to assure somewhat normal load on the unit. On air cooled units, the head pressure must be at least 150 lbs. and on water cooled units 120 lbs. before superheat readings are made. This can be adjusted by blocking the condenser air on the air cooled unit and adjusting the water valve on the water cooled unit. With the above conditions prevailing, proceed as follows.

Attach a pressure gauge to the line from the discharge service valve. Using a tee and connecting lines of copper tubing, attach a cylinder of Freon-12 and a compound gauge to the suction service valve. Purge air from the charging line. As shown in Figs. 14 or 15, clamp the bulb of a remote indicating thermometer to the suction line near the compressor, sliding it under the sponge rubber insulation and making sure that good contact is secured. Turn the compressor suction and discharge service valves in one-half turn. Replace the celotex panels. *See that all panel joints and window duct connections are air tight.* This is important.

Start the unit and allow it to run until a balanced condition has been reached, then check the readings of the gauges and thermometer. There should be approximately 8 to 12 degrees superheat, that is, the thermometer should read 8 to 12 degrees higher than the saturation temperature corresponding to the suction pressure. With a low entering air wet bulb temperature (62 degrees F.) the superheat should be nearer 8 degrees whereas with a high entering air wet bulb temperature (72 degrees F.) the superheat should be nearer 12 degrees F.

If the superheat is found to be too high,





Figs. 14 and 15 showing methods used in checking the refrigerant charge on high-side float air conditioning units by the superheat of the return line.

the change is too low and it will be necessary to add refrigerant. A high superheat (18 to 20 degrees) will result in very poor refrigeration.

To add refrigerant, hold the cylinder of Freon-12 with the valve up, and with the unit running, open the valve and heat the cylinder slightly.

After a short period, close the valve on the cylinder and after allowing sufficient time for conditions to become constant, check the superheat. If the superheat is still excessive, add more refrigerant. Use care in adding refrigerant to avoid overcharging.

If the superheat is found to be too low, the charge is too high and will result in considerable oil slugging and poor refrigeration. Under no circumstances should the crankcase run cold as this will indicate overcharge. If the superheat is too low, it will be necessary to remove a portion of the charge. This may be done by purging from the discharge service valve. After purging, again check the superheat.

Care should be used in both adding or removing refrigerant as the superheat is affected by comparatively small changes in the quantity of refrigerant.

The level of the lubricating oil in the crankcase normally stands at a depth of 1½ inches to 1¾ inches. If the oil level is low, the refrigerant charge will in all probability be low. The refrigerant charge should be checked as above and corrected before adding oil.

Changing Float Assembly

The refrigerant can be removed from the system on units illustrated in Figs. 6, 8, 9, 10, 11, 12, and 13 by the following procedure. Connect an empty cylinder into the discharge service valve and turn the stem all the way in. Connect the opening in the suction service valve to the opening in the service valve or purge cock on the float, a compound gauge must be in the connecting tube. Open the suction and float chamber valve half way. Place the cylinder in a pail of cool water and pump the refrigerant from the high and low pressure side into the cylinder.

On the system illustrated in Fig. 7, no service valve is provided on the float or receiver. The refrigerant in the low side can be pumped into the cylinder as above. The few ounces left in the float can be purged out or distilled into the cylinder by placing the cylinder in a pail and packing with salt and ice.

Before opening any part always balance the pressure on that part of the system.

Removing Air

On units provided with an opening in the float as outlined above, connect a refrigerant cylinder into the connecting tube between the float and the suction service valve with the discharge service valve turned all the way in, and the gauge opening open. Pump a vacuum on the high and low pressure side. Plug the opening. Admit refrigerant from the cylinder and test for leaks. Cut off the by-pass and arrange the service valves for normal operation. Pump in the proper charge.

On the system illustrated in Fig. 7, the air can be pumped out of the low side and refrigerant added until a positive pressure of 20 lbs. is in the condenser and float. Purge to balance pressure and repeat the operation twice. A vacuum can be pulled on the condenser by disconnecting the condenser at the discharge service valve and placing a jumper from the condenser inlet to the suction service valve. When the proper vacuum is reached on both high and low sides, stop the unit and admit refrigerant until the pressure on the high and low side is 10 lbs. Break the jumper connection and quickly transfer the condenser inlet back to the discharge service valve outlet. This permits the 10 lbs. pressure to bleed out, no air entering during the time required to transfer the condenser inlet to its proper place.

Removing Non-Condensable Gas

On all systems with a service valve or purge cock on the float assembly, purge from this opening. On systems as illustrated in Fig. 7, purge from the discharge service valve. All the gas in the condenser will have to be purged to remove the air from the top of the float. Purge until a change in the temperature is noted at the approximate liquid level in the float chamber.

Always check the refrigerant charge after purging. It is very easy to purge sufficient refrigerant to render the system inoperative.

(Concluded)

✕ ✕ ✕

Ray C. Albers
North Dakota

I just got through reading a couple of copies of your excellent magazine, THE REFRIGERATION SERVICE ENGINEER, and as I am doing this sort of service work, I will say I was very much pleased with it . . . this is the best service magazine I have ever had the pleasure to read.

Second Article (Concluded)

The Bomb Method of Evacuating and Charging

CONCLUDING the description of the unique method of charging Westinghouse units

By G. S. McCLOY and A. W. HALEY*

A PERCENTAGE of all production units are analyzed each day for determination of non-condensable and refrigerant content as a means of control of the factory process. Each time any change is made in the unit, the effect of this change on the process is carefully checked before releasing the new unit for production. The apparatus for this analysis was developed by Dr. H. M. Elsey, Westinghouse Research Laboratories, and it is due in a large part to his cooperation that the process has been successfully applied to production. The apparatus, shown in Fig. 4, consists of a gas collecting vacuum pump, which evacuates the unit through a Pyrex glass trap immersed in a Pyrex thermos flask that is filled with liquid air. Before analysis, the unit is operated long enough to drive the refrigerant dissolved in the oil back into the system, from which it is more quickly evacuated. The vacuum pump is also operated in order to warm it up thoroughly. The trap is weighted to establish its tare weight, and connected in place between the unit and the vacuum pump with rubber tubing. The trap is then immersed in the liquid air. The tube from the trap is closed with a pinch clamp at the end near the unit. The pump is allowed to operate long enough to evacuate the system, with the stop cocks connected so the system exhausts directly to the atmosphere. The system is checked for complete evacuation and freedom from leaks by turning the stop cocks so as to pass any air remaining in the system into a burette. The system is considered satisfactory for use if there is no change in the burette level in a five-minute interval.

Any unit taken from the final production line is hermetically sealed because the bomb has been pinched off. There is, therefore, no place to attach the tube from the trap. A hole, about .020 inch in diameter, is drilled into the bomb connecting tube just below the pinch seal. The drill is removed, and the end of the rubber tube is immediately pushed down over the bomb connecting tube. The pinch clamp attached to the tube is loosened, so the contents of the unit may be passed into the flask. It is usually necessary to throttle the flow slightly during the first few minutes of the test, to avoid refrigerant passing through the trap and over into the burette. The small hole in the bomb tube acts as a satisfactory throttling member. The refrigerant solidifies in the trap, but all non-condensables pass on into the burette where they displace an amount of water equivalent to their own volume. The level of water in the burette is balanced by a leveling bulb, thus insuring measurement of the non-condensables under atmospheric pressure.

Readings of the volume of collected non-condensable gases are recorded every minute for at least twenty minutes, or until the level in the burette shows less than one cubic centimeter change in one minute. Cessation of boiling of the liquid air indicates that all the refrigerant has been withdrawn from the unit. Then the clamp on the pump side of the trap is closed, and the vacuum in the trap side of the system is broken. The trap is then removed and its weight recorded. This weight, less the established tare, gives the weight of refrigerant removed from the unit.

In like manner, the bomb that had been pinched off from this unit is analyzed, but this time a direct connection may be made

*Westinghouse Electric and Mfg. Co., Springfield, Mass. Paper presented before the Joint Meeting of the A.S.R.E. and R.S.E.S. Chicago, January 17, 1940.

to the apparatus by means of a flare nut and fitting. Because of the large amount of non-condensables present in the bomb, it is necessary to use two burettes so connected by stop cocks that one may be collecting while the other is discharging its collected non-condensables to the atmosphere.

By air analysis test of a great many units it was found that even under the most favorable conditions previous methods left from 100 cubic centimeters to 200 cubic centimeters of non-condensables in the unit. The bomb method results in an average non-condensable content of about 25 cubic centimeters at atmospheric pressure. This amount is safely below the figure of 50 cubic centimeters established as a production limit.

Evacuation and Charging of Bombs

After the bomb is removed from the unit and before it is refilled with refrigerant it is necessary to remove the mixture of refrigerant vapor and non-condensables. To

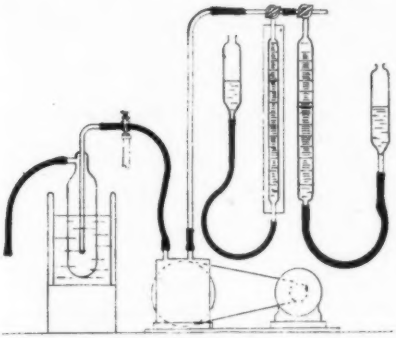


Fig. 4. Analysis apparatus.

overcome the difficulties of previous methods of charging we developed the charging machine shown in Fig. 6. This machine will automatically evacuate and then accurately charge the bomb with a pre-determined refrigerant charge. It is only necessary that the operator attach a bomb to the machine, move a lever, and depress a button at the start of the charging operation.

The charging machine consists essentially of a two platform over-under balance and an electric relay system that is so designed that completion of one operation is necessary before initiation of the following one. Attachment of the bomb was made easy by utilizing a shoulder on the bomb inlet tube which permitted the use of a simple clamping device. After the bomb is attached to the bomb carrier, movement of the handle lowers them on to the balance platform. Depression and release of a button starts the sequence of operations. First a magnetic valve opens, allowing the gases in the bomb to be discharged into the vacuum line which is connected to the magnetic valve by a flexible tube. When the pressure in the bomb has been reduced to a pre-determined value a vacuum switch operates which closes the vacuum magnetic valve. A taring motor operates, while the bomb is being evacuated, to move the taring device to the lower

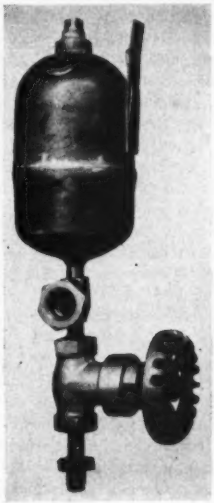


Fig. 5. Bomb container for refrigerant and non-condensables.

limit of its travel. This taring device consists of a chain, one end of which is attached to the weight platform and the other end attached to a movable arm actuated by the taring motor. All bombs are weighted to balance within the tare adjustment range of the taring arm.

When both the evacuation and the movement of the taring arm are complete, a counterweight equal in weight to the amount of refrigerant to be put into the bomb is lifted off the weight platform. The tare arm then begins its movement toward the upper limit of its travel. As the empty bomb is balanced by the taring device the balance pointer moves to its mid-position where it actu-

ates a mercury switch. The tare motor stops and the counterweight is lowered to the balance platform. This moves the balance pointer back to its original position where it actuates a mercury switch which opens two magnetic valves. These valves are connected in parallel to the refrigerant supply line through a flexible tube. One of the magnetic valves has a large orifice which permits the major portion of the refrigerant to be charged into bomb at a very rapid rate. The other valve has a small orifice which permits charging the remainder of the refrigerant into the bomb slowly to prevent over-travel. When approximately 90 per cent of the refrigerant has been supplied the pointer starts to move toward its mid-position. This operates the mercury switch which closes the large orifice magnetic valve, allowing the remainder of the refrigerant to flow into the bomb through the small orifice valve which moves the pointer to the mid-position. The switch at this point then closes the valve and returns the relay system to its original condition. After the bomb is filled the handle is pulled back which lifts the bomb carrier off the balance platform. The hand valve on the bomb is then closed, but before removing the bomb from the machine the operator presses a button which opens the vacuum magnetic valve independently of the rest of the electrical system. This evacuates the small quantity of refrigerant remaining in the tube between the bomb and the magnetic valves.

After the bomb is removed from the charging machine, it is tested for leaks, and just before attaching each bomb to a unit the bomb is weighed to insure the correct refrigerant content.

This charging machine can deliver a bomb every thirty seconds charged within plus or minus one eighth of an ounce. The machine has been in operation for a substantial period of time and has given trouble-free service during this period.

Refrigerant Reclaiming Method

The loss of refrigerant left in the bombs at the present price of Freon-12 was sufficient to warrant investigating some method of salvage. This resulted in the development of another apparatus to reclaim this refrigerant. Fig. 6 is a line diagram of this apparatus.

The problem involved in the reclaiming is the separation of the non-condensable gases from the refrigerant. If the temperature of a container in which there is a mixture of refrigerant vapor and non-condensable gas is lowered, a point is reached where condensation of the refrigerant starts. Lowering the temperature further condenses more of the refrigerant, reduces the refrigerant vapor pressure, and lessens the density of the refrigerant vapor. There is, however, no marked change in the non-condensable gas as the temperature is lowered but the total pressure of the mixture has been reduced because of the reduced refrigerant pressure.

If additional mixture is added the refrigerant will condense until its vapor pressure is that corresponding to the temperature.

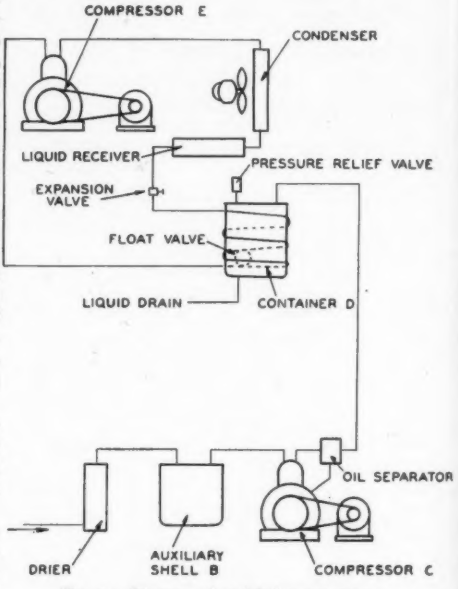


Fig. 6. Diagram of reclaiming apparatus.

The refrigerant vapor pressure therefore does not increase, but the total pressure in the container will be increased due to the added non-condensables. Thus, by keeping the temperature of the container low and the total pressure high, the major portion of the refrigerant added will be condensed. The gas mixture above the liquid will contain a low percentage of refrigerant vapor and a high percentage of non-condensable gases. This gaseous mixture can then be allowed to escape with little loss of refrigerant.

Assume that in our container the mixture is maintained at a pressure of 200 lb. per

sq. in. gauge and at a temperature of 0 degrees F. If under these conditions one cubic foot of the mixture is allowed to escape, it will contain, by equation (3) .610 lb. of refrigerant and, by equation (4), 1.12 lb. of air.

Vd = pounds of refrigerant (3)
V = volume in cubic feet
d = density of saturated vapor at 0 degrees F., pounds per cubic foot

$\frac{PV}{BT}$ = pounds of air (4)
P = Air pressure, pounds per square foot absolute
V = volume, cubic feet
B = gas constant
T = temperature, degrees F. absolute

Analysis of Bomb

Analysis of an average bomb after removal from the unit showed it contained .02 oz. of non-condensables and .8 oz. of refrigerant. The number of bombs required to supply the weight of air in the cubic foot of mixture released from the container would be:

$$\frac{1.12 \times 16}{.02} = 896 \text{ bombs}$$

These bombs would supply:

$$\frac{896 \times .8}{16} = 44.8 \text{ pounds of refrigerant to the container.}$$

Therefore, the percentage recovery is:

$$\frac{44.8 - .610}{44.8} = 98.5$$

The outlet from the Kinney type vacuum pump which is attached to the bomb charging machine discharges through the dryer to a shell B, in Fig. 6. A compressor C takes the gas mixture from this container and discharges it into container D. The container D is cooled by tubes attached to the outer surface. These tubes are the evaporator of a refrigerating system, the compressor of which is indicated by E. The container D is thoroughly insulated. Attached to the top of D is a pressure relief valve adjusted to open when the pressure in the container exceeds 200 lb. pr. sq. in. gauge. At the bottom of the container is a float valve which allows the condensed refrigerant to be drained into a storage tank.

Analysis of the reclaimed refrigerant showed that its non-condensable gas content was very low. Without close control, however, the moisture content might vary too much to make it safe to use in our refrigerating units. This reclaimed refrigerant can be returned to the refrigerant manufacturer. We were, however, able to use this refrigerant in a different application that did not require close attention to the moisture content. Thus, we were able to recover its full value.

(Concluded)

DECISION AFFECTS REFRIGERATION SERVICE

A DECISION handed down recently by a high court stated that generally speaking, any firm or person who holds himself out to the general public as being experienced in servicing refrigerating equipment is liable for damages negligently caused the owner of a refrigeration plant. In other words, a repair man is obligated to be reasonably proficient, otherwise he or the firm he represents may be liable for damages which he effects.

The ruling is important to refrigeration service engineers, in that it points out the responsibility the service man assumes when he assures the purchaser of his ability to perform the services he contracts to do. It is, therefore, of the utmost importance that the service engineer must keep himself currently informed on all developments occurring in his field.

ANTI-STATIC GLYCERINE COMBINATION FOR BELTS

STATIC electricity on fan belts of automobiles, refrigeration equipment and the like, aside from its generally dangerous nature and interference with radio reception, is apt to give unpleasant shocks when metal parts are touched. The friction which is the cause of the static electricity, however, may be reduced by means of a mixture of glycerine and graphite, applied at the points of friction.

The gycerine-graphite mixture is also an excellent lubricant, valuable not only because it is insoluble in most organic solvents but also because it retains its activity at very low temperatures and extremes of weather. Being non-toxic, glycerine alone or in combination with graphite, may safely be employed as a lubricant for food-treating equipment.

Second Article *(Concluded)*

Refrigeration System of Liquid Carbonic Soda Fountains

By JOHN G. PRAETZ*

"SIMPLEX" SODA FOUNTAINS

THE Liquid "Simplex" soda fountain Fig. 5 is a lower priced complete fountain, designed for light load locations where the volume of business permits only a modest investment in fountain equipment.

The refrigeration system on this line has been developed around the principle of hold-over refrigeration incorporating hold-over plates in the ice cream storage section.

Fig. 6 shows the 1939 "Simplex" refrigeration system. The only changes made in this system as compared with the 1937-38 "Simplex" fountain were the addition of a check valve in the suction line from the ice cream section refrigerating plates and the change from the TEV-21 to TEV-18, having a smaller orifice, for both the water bath evaporators and the ice cream evaporator refrigerant control valves. The result of these changes has been a greatly improved operation with much lower power consumption and operating costs.

The refrigerating plates maintain all the ice cream holes at approximately the same temperature with a minimum of variation from top to bottom of the hole.

Installation

The installation of the "Simplex" line is the same as installation of the "Lifetime." Two electrical switches must be used with the thermostatic switch maintaining positive and independent ice cream section temperatures. A dehydrator and a liquid line sight glass should be installed in the liquid line and 3/8 and 5/8 inch lines should be used to connect to the condensing unit. The thermostatic switch is supplied with the fountain.

The low pressure switch should be set for a cut-in of about 35 lbs. with a cut-out about 8 to 10 lbs.

The refrigerant charge for the water bath cooling section is approximately 2 lbs. of Freon while the charge for the ice cream section is approximately 3/4 of a lb. for each refrigerated plate, four plates requiring three lbs. Refrigerant should also be added to take care of the 3/8 liquid line as well as oil in proportions of 1/10 lb. of oil for each pound of Freon of the total amount added to the system.

Adjusting Procedure

The adjusting procedure on the "Simplex" soda fountain follows that outlined previously for the "Lifetime" fountain including the opening of the valves on the ice cream evaporator.

After the water cooling section adjustments have been made and the ice cream evaporator valves all opened, permit the condensing unit to operate until the ice cream section has pulled down to temperature and the condensing unit cycled a few times before attempting to make any adjustments on the expansion valve for the refrigerating plates. All TEV-18 refrigerant control valves are factory set to maintain a 10 degrees superheat in the refrigerant vapor at the expansion valve bulb location insuring complete vaporization of the refrigerant. Readjustment will increase or decrease the superheat at the bulb. In checking the adjustment, open the valve (raise) until the frost extends along the suction line through the heat exchanger with the condensing unit operating. Then turn back on the adjustment until the frost line stops at the expansion valve bulb. The bulb of the expansion valve is clamped to the suction line header near the outlet connection and should be on the back side of the line so that warm air will not hit the bulb when the cover is opened.

*General Service Manager, Soda Fountain Div., Liquid Carbonic Corp.

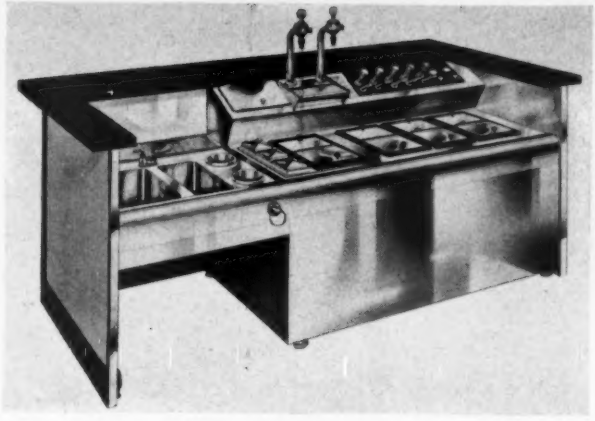


Fig. 5. The 30 gallon Liquid "Simplex" Soda Fountain.

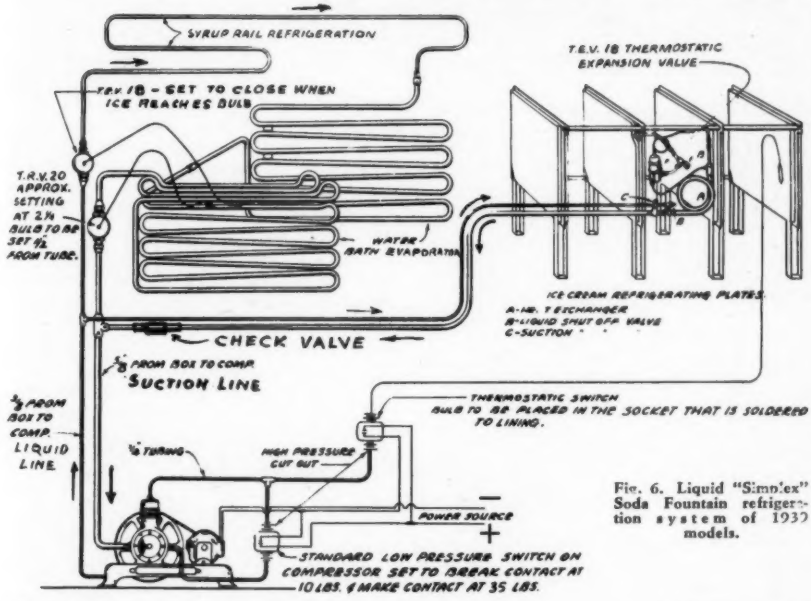

SYRUP RAIL REFRIGERATION
T.E.V. 1B THERMOSTATIC EXPANSION VALVE
T.E.V. 1B - SET TO CLOSE WHEN ICE REACHES BULB
T.R.V. 20 APPROX. SETTING AT 2¼ BULB TO BE SET ½ FROM TUBE.
WATER BATH EVAPORATOR
ICE CREAM REFRIGERATING PLATES
A-NO. 1 EXCHANGER
B-LIQUID SHUT OFF VALVE
C-SUCTION " "
CHECK VALVE
⅝ FROM BOX TO COMP. SUCTION LINE
⅜ FROM BOX TO COMP. LIQUID LINE
THERMOSTATIC SWITCH BULB TO BE PLACED IN THE SOCKET THAT IS SOLDERED TO LINING.
⅜ TUBING
HIGH PRESSURE CUT OUT
POWER SOURCE
STANDARD LOW PRESSURE SWITCH ON COMPRESSOR SET TO BREAK CONTACT AT 10 LBS. & MAKE CONTACT AT 35 LBS.

Fig. 6. Liquid "Simplex" Soda Fountain refrigeration system of 1939 models.

The bulb from the thermostatic control switch should be inserted in the well provided at the side of one of the refrigerating plates.

Fig. 7 shows the heat exchanger, expansion valve and shut-off valves. A suction shut-off valve, a liquid line shut-off valve and an evaporator liquid shut-off valve are provided to facilitate servicing operations. The expansion valve can be replaced by merely closing the liquid line shut-off valve and the evaporator liquid shut-off valve without the necessity of pumping down the entire evaporator. The shut-off valves were discontinued in the 1939 line while the length of the heat exchanger was increased.

Special Red Diamond Soda Fountain

Fig. 8 shows the 20 gallon "Red Diamond" complete soda fountain which is built also in the 20 gallon bulk ice cream size with

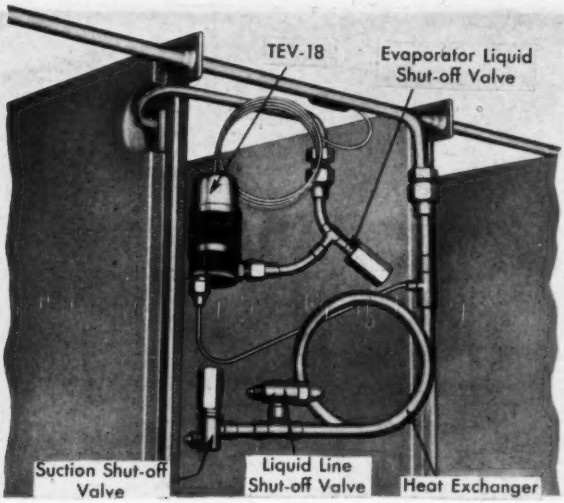


Fig. 7. Heat exchanger, expansion valve and shut off valve details on "Simplex" ice cream evaporator.

a light water cooling capacity and special small water and soda cooling coils. The soda fountain has a hold-over tank similar to the "Lifetime" line.

Installations

The same installation conditions as described on the "Lifetime" and "Simplex" fountains applies to this fountain likewise.

Adjusting Procedure

Fig. 9 shows the refrigeration hook-up on the Red Diamond fountain. The refrigerant charge for the water bath evaporator and syrup rail refrigeration line is approximately one lb. which must be added at the time of installation along with sufficient refrigerant and oil for the liquid line to the condensing unit. The ice cream evaporator valves may be opened at the time of starting up the condensing unit and the entire fountain pulled down to temperature. The TEV-18 is factory set for 10 degrees of superheat at the bulb and it will generally not be necessary to make any change in this adjustment. The frost line on the drier coil in the dry storage section should extend to about the bulb location on the line. The ice formation in the water bath and syrup rail is controlled by the automatic regulating valve (ARV) or two temperature valve. Turning the adjustment clockwise will produce colder temperatures and more ice. Turn this adjustment only a slight amount at a time and permit the system to become balanced again before readjusting this control.

The ice cream section is controlled by a thermostatic switch with the low pressure switch setting as previously described.

Inability to obtain ice in the syrup rail

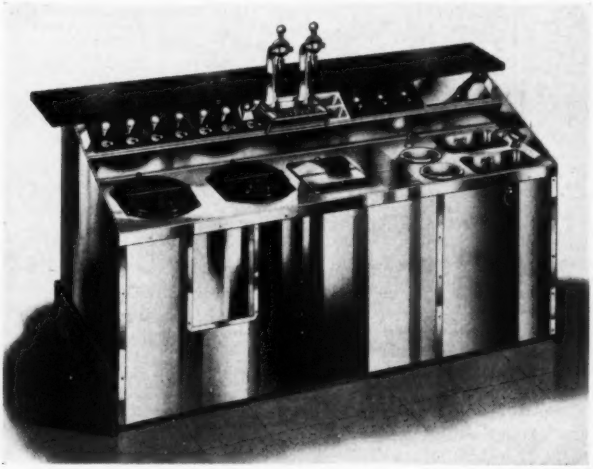


Fig. 9. Red Diamond Soda Fountain.

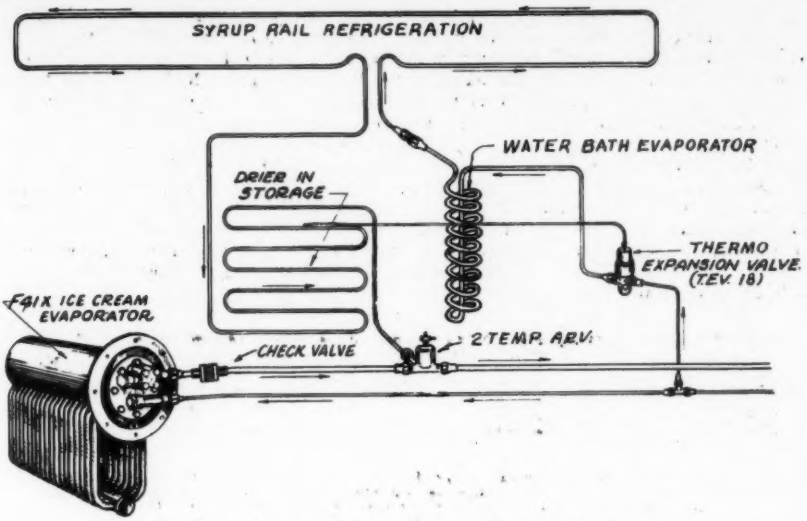


Fig. 9. Red Diamond soda fountain refrigeration system of 1939.

will indicate a shortage of refrigerant, expansion valve not open wide enough, or two temperature valve not set cold enough.

General

Use the proper size condensing unit for the fountain and this will be determined not only by the size of the fountain but by the water cooling load and whether or not a salad or back bar unit is multiplexed with the soda fountain. Too small a condensing unit will result in long or continuous operation and possibly soft ice cream. Too large a condensing unit will be difficult to adjust and control fountain ice formation and temperatures while at the same time causing heavy operating costs and service expense. Over size condensing units likewise have a tendency to short cycle on light load conditions. Pulley sizes likewise should be checked, for too large a pulley at the normal operating back pressure may over-load the motor while too small a pulley may cause excessive operating costs through long partial load operation of the motor.

In general much better temperature control and less service trouble will result if the fountain is connected to its own condensing unit with a second condensing unit being supplied to refrigerate a salad unit and back bar, particularly if these latter are large units.

Moisture in an F-12 soda fountain system will freeze out, restricting or plugging the orifice at the coldest evaporator refrigerant control valve, the thermostatic expansion valve or low side float valve. The compressor will operate continuously with little or no refrigeration at this evaporator and consequent high temperatures and soft ice cream. Install a drier in the liquid line if one is not already there and be sure it is charged with fresh dry dehydrating material. A second large drier installed in the suction line will shorten the time required to dry out the system. Apply heat to the expansion valve to completely melt the ice. A hissing noise will be heard generally when the ice melts at the orifice and lets the refrigerant rush into the evaporator, and the suction pressure will rise rapidly. Moisture freezing at the valve acts the same as a plugged screen or line in that it prevents refrigerant from entering the evaporator. Let the driers remain in the system for about a week and then remove them. The service man must always use extreme care to prevent moisture from getting into the system particularly when breaking frosted or sweating connections. Don't break a connection while it is cold and wet for it takes but a slight amount of moisture to cause trouble. Likewise be extremely careful when adding oil and refrigerant, making sure that no air or moisture are drawn into the system.

If a system loses part of its charge and becomes short of gas, locate and correct the leak. To merely add more refrigerant will result in a call back later, besides being an expensive waste of refrigerant. Generally a leaking connection will have a film of oil around it, the oil of course having escaped with the refrigerant and remained around the leaking joint. Halide lamps or torches are best for locating leaks and may burn anhydrous alcohol or Presto-lite, the flame of course changing color in the presence of Freon. If the system is short of refrigerant, bubbles of vapor will pass through the liquid line sight glass with the slugs of liquid. When the charge is sufficient the flow through the sight glass will be clear and colorless.

When the bulb of the thermostatic switch is inserted in the ice cream evaporator well be sure to fill the well with glycerine or refrigerant oil and plug the hole with the slip stopper supplied. Failure to insert the stopper plugging the well may permit moisture to enter which will freeze and may split the well, making it necessary to replace the evaporator along with loss of the hold-over solution out through the split well.

(Concluded)

SERVICE KINKS

Tools and Equipment You Can Build

Under this heading will appear simplified or short cut methods of performing individual service operations; also details of how you can build special tools and equipment for your own use. Readers are invited to submit information for publication under this head.

Hydraulic Crane for Handling Refrigerators

By AN R.S.E.S. MEMBER

A GREAT many times refrigerators come into the shop for repairs and there is no one there to help unload them. Quite often dealers will send in a job and the truck driver has to wait for one of our fellows to help him unload. To lift an eight foot box off the truck is hard work for four men. Last winter when business was slack we made a crane to handle such jobs as they came in. We used old scrap materials that can be found around most any repair shop. We went to a local bakery and bought an old proof rack that had good heavy casters on it. The base was made smaller, having an outside dimension of 24 inches x 40 inches. The vertical sides or tracks are 2 x 4 scantlings braced with 1½ inch angle iron. The lifting platform is made of two inch angle iron firmly braced so as to eliminate the possibility of the load tipping side ways. See Fig. 1.

We spent considerable time deciding the best method of lifting the platform up and down on the side rails. We selected the hydraulic method as the safest and most suitable. There are no cables to let go and it can be operated easily with one hand leaving the other hand free to balance the refrigerator if necessary. The lifting cylinder is a four foot piece of 1⅝ inch copper tube. The piston is a piece of one-half inch conduit with two one and one-half inch pump leathers set an inch apart. The oil pump is a piece of one-half inch iron pipe 8 inches long. The pump piston is a piece of one-half inch rod 8 inches long. The check valves are old refrigerator check valves. The oil lines were made of one-quarter inch tubing but we found later that three-eighths inch tubing works better in cold weather. We used a light grade compressor oil for the hydraulic fluid. The oil reservoir is a gallon oil can with a small hole punched in the top for a vent. Details of the lift are shown in Fig. 2.

Cost Less Than Five Dollars

The material that we had to buy cost us less than five dollars. The building took one man about two days. On refrigerators that have no legs we use pallets to carry them. These pallets are 28 inches x 86 inches and 8 inches high. We pick one of these up on the crane and slide the crane up to the truck so that the pallet is about one inch lower than the truck floor. We then slide the refrigerator about one-third off the truck onto the pallet. We pump the crane platform and pallet up about three inches and then slide the refrigerator the rest of the way onto the crane. The reason we use this procedure is the truck springs

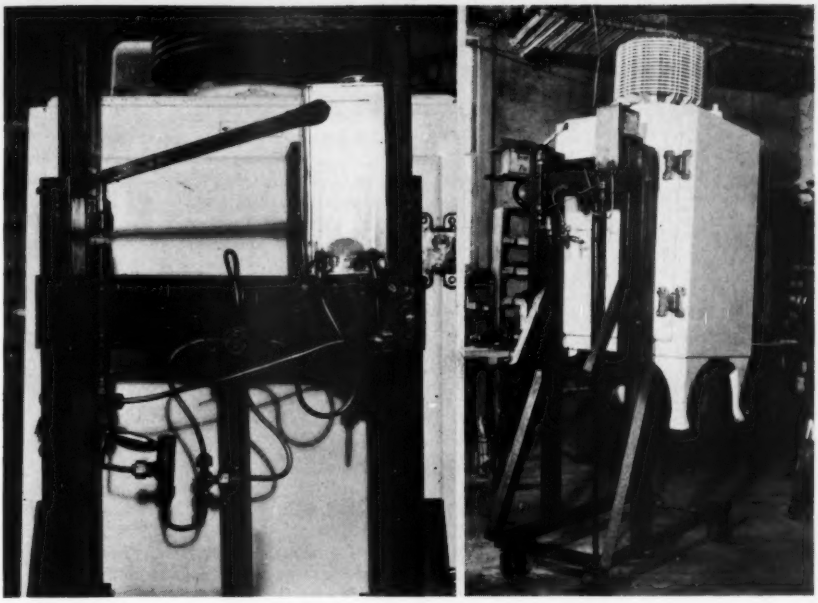


Fig. 1. (Above). Two views of the completed hoist in use.

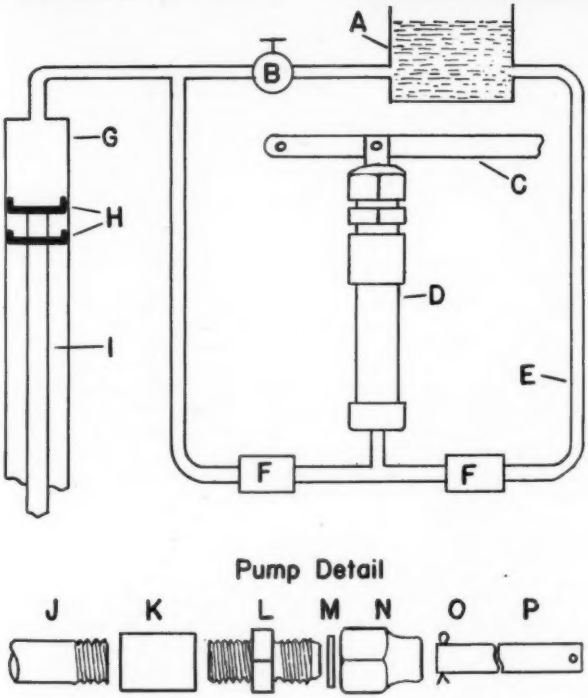


FIG. 2. DETAILS OF THE PUMP AND HYDRAULIC HOIST.

A. Oil reservoir
B. Hand valve to lower crane
C. Pump handle
D. Pump
E. ⅜" oil lines
F. Check valves
G. 1⅜" cylinder
H. 1½" pump leathers
I. ½" conduit
J. ½"x8" nipple used as cylinder
K. ½" pipe coupling
L. ½" to ⅜" half union
M. Packing
N. ⅜" to ½" reducing nut
O. Cotter pin to prevent piston from pulling out
P. ½"x8" rod used as a piston

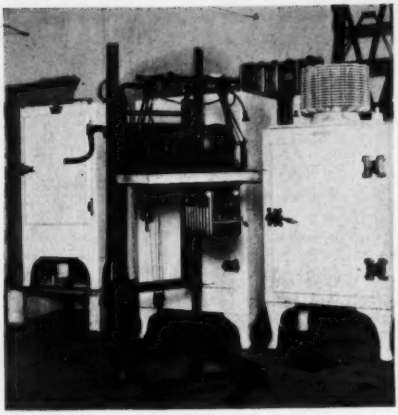


Fig. 3. Cable type crane used for lifting hermetic units from cabinets on the customer's premises.

raise the body about two inches when the load is shifted to the crane. The refrigerator is left on the pallet while it is in the shop for repairs.

We also have another crane shown in Fig. 3, for lifting units out of boxes such as G. E., Westinghouse and Crosley. It is made a great deal lighter so that it can be easily carried into the customers home to remove a unit for repair. This crane is a cable type because the oil in a hydraulic proved a bit too messy to use in a customer's home. As a safety feature we used a double cable arrangement so that if one breaks the other will hold.

THE SERVICE POLICY OF SEARS ROEBUCK AND CO.

Numerous requests from readers of this journal for information on the servicing of Coldspot refrigerators and for a source of supply for replacement parts prompted a request to Sears Roebuck and Company for a statement which would clarify the situation. The answer received from them is quoted in part in the following. It clears up much of the misunderstanding concerning the policy of this company.—Editor.

"INASMUCH as we receive some 150 to 200 letters per year from independent organizations requesting parts, catalogs, and service information, and in order that we may not be misunderstood in our reasons for adopting our present policy, the following explanation is offered.

"Sears are directly responsible for the satisfactory performance of any article sold by them. They are organized to serve the customer directly, and have no facilities for jobbing or wholesaling parts. This is the fundamental concept on which the business has been built.

"When we first contemplated going into the electric refrigeration business, we realized that it would be next to impossible to set up and train a service organization comparable to some of the manufacturers already in the business. Therefore, in order to compete successfully, we had to eliminate the possibilities of inadequate or unsatisfactory service. To this end the unit was designed to be easily installed and removed by the customer. It must be remembered that the present retail organization grew out of a mail order organization where the customer was expected to uncrate and set up the merchandise himself. It was also designed to be as fool-proof and service-free as possible. For this reason the expansion valve was selected instead of the then popular lowside float. The conventional type of unit was decided upon instead of the hermetic which was then in the earlier stages of development.

"We did not at that time, nor do we at present, expect our stores to make actual repairs. The service operations which our stores are authorized to perform are relatively simple. They include adjustment of the expansion valve and thermostat, replacement of the thermostat, replacement of the motor and capacitor, replacement of accessory parts, flushing the expansion valve, and correcting an occasional seal leak by a simple run-in process. All repairs involving opening of the sealed system are prohibited. In such cases, the stores will exchange units with the customer, if of a current model, or will loan the customer a service unit while his own is returned to the factory or factory repair branch for reconditioning. We do not authorize our servicemen to add oil or refrigerant.

"We have a comprehensive system of repair stations scattered over the country so that nearly all customers are within an overnight shipping distance from a repair station. The average time of a unit in the repair station is about four days. The factory repair stations are very thoroughly

equipped and in charge of factory-trained managers. They are supervised and supplied with parts directly from the factory. Under this arrangement, the customer is given a factory reconditioning job which, in old models, is superior to the original quality due to the adaptation of improvements. A one-year guarantee covering every part of the unit is given on each reconditioning job.

"Under these conditions, you can see that we are reluctant to provide parts and service information to independent repair organizations of whom we know nothing and over whom we cannot exercise control. We are very much concerned with the type of service which our customers receive and with the prices which they will have to pay for this repair service. We do not believe that any independent repair shop would install the necessary equipment or spend the necessary time in our factory to enable them to make repairs of a quality which we regularly provide our customers. The expense would be prohibitive.

"There is no reason for our abandoning our present policy and running the risk of jeopardizing the reputation of the Coldspot through the medium of a repair service which cannot offer the service we are in a position to render ourselves."

The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box."

DEFROSTING SYSTEM TROUBLE

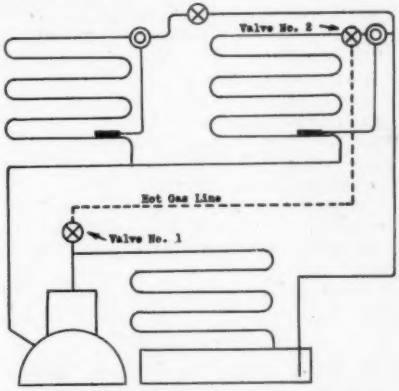
Question 381: Enclosed you will find a sketch of a refrigeration system utilizing the Warren Company idea of a defrosting system. This installation was made about four years ago, and was quite satisfactory until about three months ago when a charge of SO_2 was inadvertently dumped into the CH_3Cl unit. The system was purged, oil changed, and correctly recharged, but now the unit frosts back quite heavily during the defrosting operation. Personally, I can't see what these past happenings would do to affect the operation of the unit, but I'm giving you the history of the case for what it is worth.

According to the instructions furnished by the Warren Company, valve one is to be opened, valve two closed, and the unit operated during the defrosting period.

The installation is a 1-hp. water-cooled Kelvinator, connected to a 12-foot double duty display case and a 480-bottle dry beverage cooler. The entire cycle of operation is satisfactory except during the defrosting period.

I can't understand how wet gas gets into the suction line, unless hot gas from the compressor affects the feeler bulb of the thermostatic expansion valve, causing it to flood, in which case, why didn't it do just that before?

Answer: I, too, am of the opinion that the recent mistake and its correction of adding the wrong gas to the system has little or no bearing on the present trouble. It is probable that the trouble has been developing for some time, but being slightly short of gas it did not show up until additional gas was added.



If I understand your sketch correctly, the three-way valve between the expansion valve and the coil is so installed that when it is closed for the defrosting operation it closes off the expansion valve and opens the hot gas line to the compressor. If this is true, then no liquid refrigerant can enter

the defrosting circuit unless it is being drawn up through the hot gas line.

We can, therefore, assume that the liquid which is causing the frosting on the return line is either trapped in the coil before defrosting is begun or is being drawn up through the hot gas line from the condenser.

Since the expansion valve operates satisfactorily during normal operation we can assume that there is no fault there, and that the fault is confined to the part of the system used in the defrosting cycle.

Several possibilities present themselves, the most logical of which is this: If the hot gas valve near the expansion valve is installed as suggested above, then the valve will be open in all three directions during normal operation. This will leave the hot gas line open to the low pressure area during operation and it is quite probable that considerable liquid refrigerant will gradually become condensed in this line. When the defrosting operation is begun the liquid is forced through the coil by the high pressure gas, causing a flooded condition.

It seems to me the instructions for operating these valves should be to close the valve near the expansion valve, permit the machine to cycle a few times until liquid is drawn out of the hot gas line and coil, then open the valve near the compressor.

The second possibility is that there is too much refrigerant in the system and too large a reserve supply in the receiver. In this case it is possible, but I don't think probable, that the rush of high pressure gas out of the condenser when the valves are first opened draws liquid refrigerant with it.

The third possibility is that if the suction line is so arranged that it takes an upturn immediately after leaving the bottom of the evaporating coil, there may be a certain amount of liquid being trapped in the coil during operation. This liquid would then be forced through by the high pressure gas. The change in operating instructions would also take care of this.

These are my opinions and I hope they will help.

WATER COOLING

QUESTION 382: I have a customer who wants to cool 200 gallons of water per hour, from 55 degrees to 33 degrees. This party has a large ammonia plant that runs continuously. They have a condenser which they would like to use to cool this water. This is a double pipe condenser with 1¼ inch inside pipe, 72 feet long. Would this be enough surface to cool the above amount of water? I know how to hook this up, but would like to know the capacity of this coil.

ANSWER: The definition of a B.t.u. states that one B.t.u. equals the amount of heat required to raise one pound of air one degree Fahrenheit.

Two hundred gallons of water will weigh 1670 pounds, and since you wish to cool this water through a temperature difference of 22 degrees, the 200 gallons will contain 1670 times 22 equals 36,740 B.t.u.

72 lineal feet of 1¼-inch pipe contain a total square foot area of about 31 square feet. If we consider that we can operate with a suction gas temperature of about 10 degrees below the final water temperature, the maximum amount of heat transfer we would be able to get through the 72 feet of pipe will be about 3100 B.t.u. per hour.

Therefore, it may be easily seen that this coil is not large enough to handle 200 gallons of water per hour. Further than this, I am of the opinion that it is not practical to endeavor to cool water to a temperature of 33 degrees with this type of apparatus. The temperature is much too close to a freezing temperature and there is too much danger of the coil being frozen up should the controls vary slightly in their adjustment or if the rate of flow of the water should slow up at any time or if it should be permitted to stop entirely.

We could not hope to operate any system with less than a 5 degree difference between the water temperature and the refrigerant temperature. This means, then, if the water was to have an eventual temperature of 33 degrees, refrigerant temperature would have to be maintained at about 28 degrees. Under these conditions there is a possibility that due to the water flow being stopped entirely the entire coil would be frozen solid.

OIL PUMPING

QUESTION 383: I am experiencing some difficulty with a Chieftain condensing unit, mounted in a beverage cooler, sold by Brunswick-Balke-Collender Company. The numbers on the unit are as follows: M-14-2-H, which means Methyl Chloride ¼-hp. twin cylinder and high back pressure.

About a week ago, the seal went bad, and upon examination, I found the cylinder head gaskets leaking also. I replaced the seal and put in new head gaskets, drained out what oil was left in the crank case and charged 20 ounces of new oil into the compressor, and also charged the unit with gas.

The machine refrigerates all right but it has a dull thump in the compressor at times, and when this occurs, the back pressure will drop from 8 to 10 lbs. below normal. It does not do this thumping all the time; sometimes it will run a full cycle without a sound of a thump, but when it does thump, you would think it was going to jump off the base. When operating normally, the machine has a back pressure of about 18 to 20 lbs., and the head pressure is normal.

I rechecked the oil in the crank case, and when I pumped the machine down so as to remove the oil plug, it thumped terribly until the back pressure dropped below 10 lbs.; then it was quiet again. When I went to remove the gauge plug on the high side and loosened the plug, the oil foamed out for five minutes or better before I could remove the plug, and that was after I had pumped the system down and had the shut-off valves closed. I had never had anything like that before, and I am uncertain as to what to do. Although I have a Chieftain Service Manual, and have looked through all of my training books, I am unable to find anything just like my trouble.

ANSWER: The thumping noise you describe in the Chieftain compressor is evidently caused by oil being pumped from the compressor, which in turn is caused by a certain amount of refrigerant being condensed in the oil. As the suction pressure is reduced and the refrigerant in the crank case begins to boil off it carries a certain amount of oil with it and is pumped over to the condenser of the highside.

It is the refrigerant boiling out of the oil which causes the oil to foam when the compressor is opened to atmospheric pressure.

I don't believe your trouble is due to the compressor at all. It must be caused by either the refrigerant control or some condition within the evaporator. You state that the suction pressure will drop from eight to ten pounds below normal when this pumping occurs. I think you will find that the pressure drops first, followed very closely by the pumping noise and it is probable that some condition within the evaporator or the refrigerant control causes the pressure to drop.

You have not given me any information regarding the balance of the system; therefore, I am not able to make any analysis of what this trouble may be. I feel sure you will find it elsewhere but in the compressor.

GASKET TOO THICK

QUESTION 384: In changing from a thin lead gasket, for head and valve plate, to 1/32 inch asbestos gasket, what would be the loss in efficiency? Would it be the cause for not being able to pump down to as low a vacuum as before?

Is there any place I could get a capillary tube that would be right for a Mayflower refrigerator? I have tried several places without results. When replacing a capillary tube, is it not necessary that it be of the exact length and diameter as the original one in order to get satisfactory results?

I have a Mayflower unit that cycles about normal if it is set for a high temperature, but if set to freeze ice, the machine runs almost constantly. The compressor seems to be O.K. —the valves holding, and it is charged so that it will frost on the suction line for a few inches out of the evaporator. Am I right to figure that it is a restriction in the tube that causes this trouble?

ANSWER: Increasing the thickness of the head valve gasket will cause considerable loss in efficiency of the compressor. It naturally follows, of course, that you would not be able to draw as low a vacuum as before. Just what the efficiency loss would be is difficult to calculate without considerably more information on the compressor. However, as the clearance above the piston at the end of its stroke increases, so the efficiency will drop quite rapidly.

There is no place to my knowledge outside of the manufacturers of the Mayflower refrigerator where you could purchase a capillary tube for this unit. There is no source of supply for ready-made capillary tubes on any make of refrigerator.

It is necessary that a replacement tube be of the exact length and diameter as the original one in order to secure satisfactory results.

I am not inclined to believe, however, that this is the cause of your trouble. If the tube were restricted you would experience trouble regardless of what temperature settings were being maintained.

The fact that the compressor runs too long when the temperature is lower indicates an inefficient compressor or insufficient refrigerant. You state, however, that you have charged this unit until frost appears on the suction line which is the correct method of determining the proper charge. Therefore, this latter possibility of trouble is excluded.

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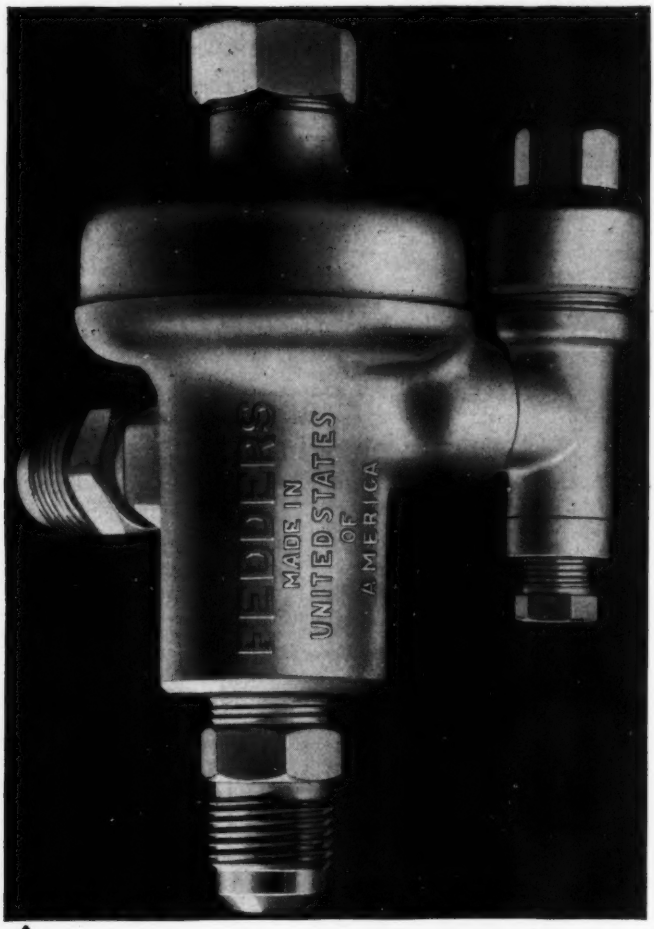

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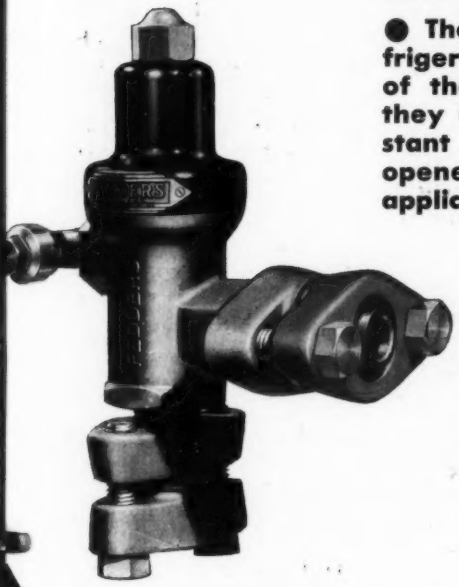

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AMMONIA VS. FREON OPERATING COST

QUESTION 385: Several times recently I have been asked to estimate the monthly savings in cost of operation that could be expected if an ammonia machine were replaced with a Freon job. So far I have had to depend on very questionable hearsay evidence, which, if true, might not apply to another installation. I realize, of course, that you couldn't possibly answer the question without knowing several variables, but can you give me some indication as to the most satisfactory way to approach the problem? Is there any thermal efficiency difference between the two units on a theoretical basis, or is the B.t.u. transfer per Kwh the same in theory for both Freon and ammonia, under same condenser and low side temperatures?

ANSWER: It is a known fact among refrigeration men that many customers have been able to effect a very appreciable savings in operating expense by replacing their ammonia installation with one of the low pressure units using Freon, Methyl Chloride or one of the other low pressure refrigerants. Yet, on the other hand, the theoretical B.t.u. transfer per Kwh for ammonia and the low pressure gases is for all practical purposes identical.

It would seem that if a fair basis of comparison was made, the cost of operation of the two units should be the same and therein, I believe, lies the answer to your question.

Those ammonia units which have been replaced by low pressure units and on which such savings in operating cost have been effected are all old style units manufactured anywhere from twenty to thirty years ago. They are heavy, cumbersome, slow moving units of obsolete construction in which a considerable amount of power is lost due to friction. They all employ big flat leather belts which are quite an expense in themselves and represent quite a lot of lost power due to friction. The systems employed bare pipe coils or brine tanks which are much less efficient than our modern fin coil and many of the systems were manually operated and employed hand adjusted expansion valves. All these things add to the inefficiency of the system.

In addition to these things which contribute to the inefficiency of the unit it was the practice in those days to add such a large safety factor to their calculations of heat losses that many of these ammonia systems were almost twice the size needed for the work they had to do.

In condemning the ammonia system as being more expensive to operate, we are being unfair because we are comparing these old obsolete systems with the modern low pressure system of today. If we were to make the fair comparison between a modern ammonia plant and a modern low pressure plant, I think we would find the operating cost comparable.

In view of the foregoing, your next question of how to determine the difference in operating cost to be expected, should be easy. If you found that a meat market was equipped with a two horsepower ammonia plant and upon making an estimate of the heat losses, etc., in the refrigerated spaces you find a 1½ horsepower unit will handle the work, it is only necessary to estimate the difference in cost of operating a two horsepower motor and a one and one-half horsepower motor over a period of a month. Of course, the owner can probably tell you how much the ammonia plant costs from his electric bills and it would then be necessary to compare this with your estimated cost on the smaller motor.

MILK COOLING

QUESTION 386: I have a tubular milk cooler, surface type. This cooler was used for cooling with brine. With the brine at 18 degrees F., it cooled the milk at the rate of 35 gallons in 40 minutes from 70 and 85 degrees F. to 50 degrees F. With a 1½-hp. Frigidaire compressor, changing this job to direct expansion cooling—of course, first washing out and baking our milk cooler—could satisfactory operation be obtained? Or would you advise a larger cooler?

The pipe size of the present cooler is ¾ inch; the gas used is SO_2; the size of the cooler is 8 x 18 inches.

ANSWER: According to my calculations, 35 gallons of milk in 40 minutes—or, in other words, 53 gallons of milk per hour—cooled through a temperature differential of 35 degrees will impose a heat load of 14,676 B.t.u. per hour on the condensing unit.

A 1½-hp. Frigidaire machine operating on a suction temperature of about 15 to 18 degrees would be capable of doing the work of about 12,000 B.t.u. per hour; therefore, with the type system you are planning on installing it is possible the machine will be somewhat overloaded or on the other hand it will probably require more than 40 min-

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utes to run the 35 gallons of milk over the cooler.

The cooler should be able to handle very nearly as much milk per hour utilizing the direct expansion method of cooling as it will when employing brine circulation. The temperature of the refrigerant will have to be maintained at 30 degrees or slightly less.

I am of the opinion in any case that the cooler you have is large enough for the condensing unit you will have connected to it and while the combination may not be large enough to handle 35 gallons of milk in the 40 minutes I take it for granted that the additional time required would not be objectionable.

DOWNING DISPLAY CASE

QUESTION 387: I have an old cooler which the owner wants to refrigerate to the low temperature of plus 10 degrees F. It was originally built for ice refrigeration and is 7 feet x 10 feet x 7 feet high, outside dimensions. It is constructed of boards and single ply paper, with one inch air space between layers of boards.

Will you please inform me the heat rate transfer of a wall of this type? Do you think that this wall construction is satisfactory for low temperature work, or is it advisable to rebuild the cooler room?

I also have a display case that acts rather peculiarly. It is a Downing 10-foot case with two end bunker coils, which are controlled by an Alco and a Fedders thermostatic expansion valve. Originally, only one valve (the Alco) was used, but it lacked capacity. I now have a ¼-hp. Frigidaire 2-cylinder air-cooled compressor, controlled by a temperature control switch connected to it. The coils are bottom feed, and the job uses about 16 lbs. of SO_2. The suction line frosts back occasionally. The coil controlled by the Alco valve collects a large amount of ice, while the other coil defrosts between cycles.

ANSWER: The construction of the cooler you have described is rather unusual, and I have no heat leakage factors which would be applicable to such a construction. From the data you have given me, I could build up a factor mathematically, but it would be only theoretical, and I'd be afraid to trust it for making any definite recommendations.

Certainly, the construction, in my opinion, is not suitable for mechanical refrigeration, and the heat losses would be too great to give it any serious consideration, and I think the most advisable thing to do is to rebuild the cooler, or make some arrangements to insulate it as it stands.

With regard to the display case, I believe your trouble is due to one of two things, first, that due to baffling arrangement, all the load is being thrown on one coil, thereby causing that one to accumulate too much frost; second, and which is most likely, there is too great a difference in the superheat settings of the two expansion valves used. Apparently, the coil that is frosting so much is doing most of the work, and it is quite probable that the expansion valve on this coil is set at too low a pressure. It may be difficult to get a proper balanced adjustment between the two controls, and I would suggest that your best manner of attacking the situation is to replace one of the expansion valves, with one identical to the other so that both would be alike.

\$ \$ \$

Leonard J. Schaefer
Washington

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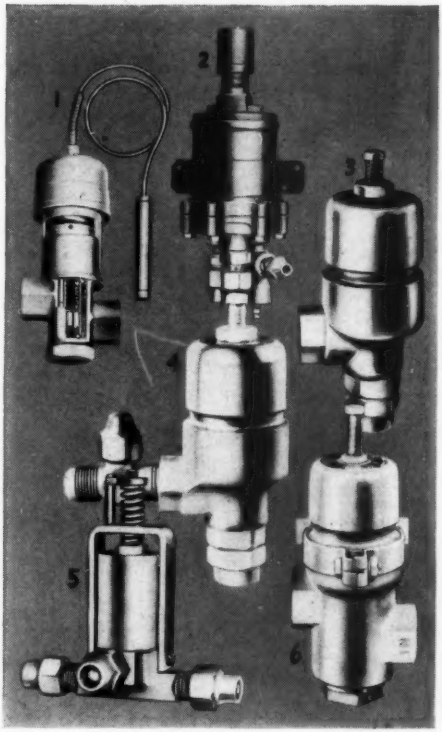

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REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

ILLINOIS STATE ASSOCIATION HOLDS ANNUAL PICNIC

ON Sunday, July 28, a representative group of members of the Illinois State Association of the Refrigeration Service Engineers Society met at Starved Rock Park for the annual picnic.

Although the weather was extremely hot, those in attendance enjoyed themselves to the fullest extent, participating in the old fashioned picnic basket lunch, and partaking of the refreshments which the committee had arranged for. It was truly a family picnic in every respect, and in addition to the entertainment provided for by the committee, many of those in attendance took advantage of the opportunity to visit the scenic points of interest which the state park has.

The Executive Committee of the State Association held a brief meeting for the discussion of the plans for the Illinois State Association Meeting, and to complete the educational program which is being prepared for this meeting to be held in Peoria, October 19-20.

All those who attended expressed their appreciation of the splendid time they had. Visitors included members from Madison Chapter at Wisconsin.

It was a hot day at Starved Rock on July 28, but those attending the Illinois State Association picnic did not let the heat prevent them from having a good time. From the above views it was apparent that the children of the industry were well represented

Pictures by Herman Goldberg, Chicago

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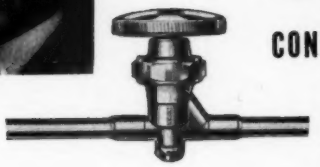

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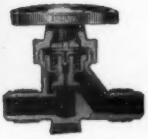

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NEW YORK STATE ASSOCIATION PLANS CONVENTION

PLANS are now being laid for the first convention of the newly-organized New York State Association of Refrigeration Service Engineers, it was revealed by John Bush, president of the organization.

Mr. Bush said he had been conferring with officers and directors in various parts of the state recently and that it had been definitely decided to hold a convention in the latter part of November. The majority of state officials favor Syracuse as the site of the first convention but some favor Albany. Syracuse, however, is more centrally located and is a logical place to hold the first meeting.

The new organization will receive its state charter at that time. The state association was formulated at the last national convention in Chicago. It went into operation March 21, electing John Bush president.

Mr. Bush said the association was formed "to bring employer and employee together on a common meeting ground. We are definitely not a labor organization. Our objective is primarily an educational and social one." Further announcements on the coming state convention will be made at a later date.

Chapter Notes

Under this heading will appear news of the chapter meetings. For names of the officers and dates of regular meeting nights, please refer to the Chapter Directory.

TWIN CITIES CHAPTER

June 18—The evening was devoted to a dinner meeting with a good representation attending. Among the visitors present was Herman Goldberg of Chicago, who showed his film on views of the National Convention, held in Chicago in January, 1940. Mr. Goldberg accompanied the film with remarks regarding the various events at the convention. Following the showing of the film, a short business session was held and the meeting was then adjourned.

July 16—During the business session of the evening H. E. Schaeffer reported for the committee who met with the State Board of Electricity. Mr. Schaeffer stated that there had been very little revision made in the work service engineers could do on the electrical equipment of refrigerators. C. A. McCafferty gave a report on work done so far in regard to a State Code, and it was explained that a revision of the code was being undertaken with a view to presenting it to the next legislature.

The subject of a bowling team to be organized for the next season, was discussed and President Warner asked for a volunteer chairman for the bowling committee. A committee consisting of I. L. Rubbelke, Chairman, H. E. Schaeffer and H. J. Sundgaard was appointed to arrange for a team. Because the office of the treasurer had been vacated, a motion was made that a new treasurer be appointed, and L. A. Ost was asked to fill the unexpired term of the former treasurer.

C. A. McCafferty's name was drawn for the attendance kitty and he applied the $5 received to his membership dues.

TRI-STATE CHAPTER

July 14—This was the date of a picnic held at Vesuvius Lake, nine miles from Ironton. All members and their families and friends were invited, but due to very hot weather, the attendance was rather poor. An old fashioned basket dinner was prepared by the ladies of the Auxiliary, and all members present enjoyed an afternoon of conversation and rest. The picnic was adjourned at an early hour, and every one returned to the home of Mr. and Mrs. Gruber, where a meeting of both the Chapter and the Auxiliary was held.

The first order of business was the appointment of a treasurer to fill the unexpired term of the former treasurer. Mr. Claude Brunton was appointed to this office. There followed a considerable period of business during which many of the members paid their dues, and an auditing committee was appointed to audit the books of the former treasurer. After the business was completed, there was a period of round table discussion on the individual experiences of the members.

The meeting was then adjourned for refreshments and ice cream served by Mrs. Gruber.

LONE STAR CHAPTER

June 1—The meeting was held in the offices of the Wolverine Tube Company in Dallas. The first order of business was a unanimous vote to accept the constitution and by-laws recommended by the National Organization, with one exception; that was an amendment that acceptable members must be American citizens.

Wolverine Tube Company extended an invitation to the Chapter to conduct its future

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meetings in its offices, requiring only that the membership should provide its own chairs. The invitation was accepted and the Chapter proceeded with arrangements to secure the necessary chairs.

Reports from the Membership Committee showed that rapid strides were being made in increasing the membership of the Chapter. Several applications for membership were registered at this meeting to be acted on at the next meeting, and Mr. Sparkman, Chairman of the committee, predicted that the membership would shortly be in excess of fifty.

A suggestion was made that the Chapter hold a picnic for its members on Labor Day and the proposal was referred to the Entertainment Committee to make arrangements.

After the meeting was over, the members were invited to be the guests of Wolverine Tube Company, and participate in refreshments supplied by the company. Tables were piled high with sandwiches of all varieties, with a quarter barrel of beer and cases of soft drinks jamming cooler boxes furnished by the company for the refreshment of the group. Ralph Thorpe of the Wolverine Tube Company acted as host to the gathering.

July 1—The constitution and by-laws as adopted by the Chapter were read by Mr. Cline for the benefit of all members present, and in order to complete the Chapter's complement of officers, the following were elected: J. R. Sparkman, *2nd Vice-President;* J. M. Bibb, *Sergeant-at-Arms;* Jack Langston and Roy Powell, *Board of Directors.* Following this election appointments were made for the chairman of the various committees: O. D. Sparkman, *Investigating Committee;* H. M. Biebel, *Committee on Standards;* J. R. Sparkman, *Membership Committee;* Elizabeth Bibb, *Committee on Cost Records;* J. L. Stephens, *Visiting Committee;* M. D. James, *Educational Committee;* E. R. Harvey, *Entertainment Committee;* J. H. McDowell, *Finance Committee.*

July 15—J. M. Bibb, of the Bibb Refrigeration Service, and one of the prime movers of the campaign which accomplished organization of the Lone Star Chapter, acted as host to the group at a basket picnic held on his home grounds. Mr. Bibb had previously extended an invitation to the group and requested only that each member bring his own tin cup and plate.

WORCESTER CHAPTER

June 14—The evening was devoted to the first annual banquet of the Chapter, held at Lunt's in Sterling, and an annual election of officers was held following the banquet. The election resulted in the following: T. Cronk, *President;* William Viner, *1st Vice-President;* Pierce Goodney, *2nd Vice-President;* Stuart Garland, *Secretary-Treasurer;* Samuel Saltus, *Chairman of Educational Committee;* John Osper, Harry Manchester, and Amos Stuart, *Board of Directors;* Charles J. Delmolino, *Sergeant-at-Arms.*

CENTRAL INDIANA CHAPTER

July 2—The meeting was held in the home of Vern Nold, and the main order of business was an election of officers for the coming year, the present officers being reinstated for a second term. A very interesting discussion developed from questions contained in the Question Box, and much useful information was gained from the answers given. After the business of the evening was completed, refreshments were served by Mrs. Nold, and the balance of the evening was spent in a social gathering.

MONTGOMERY CHAPTER

July 11—The educational program for the evening consisted primarily of discussions of experiences of the individual members. One of the subjects that was discussed was how to obtain a temperature of 25 degrees below zero with a Freon plant, and some of the difficulties encountered. Another discussion was on an ice cream plant installed in the territory which, apparently, was not properly engineered, and the experiences in correcting the troubles provided a very interesting discussion. The plant was an ammonia system.

Ladies Auxiliary Notes

For information on the formation of an Auxiliary in your locality write—
Mrs. June Brunton, President
2223—9th Ave., Huntington, W. Va.
Mrs. A. H. Ross, Secretary
702 Nevin Ave., Sewickley, Pa.

ROCKFORD AUXILIARY

In the meeting of June 3 at the Nelson Hotel, the election of officers was held with the following results: Mesdames R. C. McCarthy, *President;* L. L. Sturch, *Vice-President;* A. W. Overman, *Secretary;* W. W. Larson, *Treasurer;* E. J. Seaton, *Director.* Among other things, during the business session, the treasurer's and secretary's books were audited and signed by Mrs. A. W. Overman and Mrs. R. C. McCarthy. The

Commercial Refrigeration and Comfort Cooling

MONCHER

Just Published

A practical book

—practical in the method it provides for figuring actual load calculations.

CONTENTS

INTRODUCTION
FOOD STORAGE CONDITIONS
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TYPES OF REFRIGERATION
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SELECTION OF LOWSIDE EQUIPMENT
HIGHSIDE EQUIPMENT
SOME RECENT DEVELOPMENTS
EXEMPLARY INSTALLATIONS
COOLING FOR HUMAN COMFORT
AIR CONDITIONING FOR THE HOME

The author, with a wide knowledge of refrigeration applications, has endeavored to adapt this book especially for the use of refrigeration service engineers, refrigeration equipment salesmen, and architects. It especially emphasizes engineering methods in common use today.

It specifically treats the subject of the smaller types of commercial equipment as installed in the modern retail shop or restaurant, eliminating any discussion on domestic or industrial refrigeration application.

Its contents include valuable information on food storage conditions covering the most common commodities held under refrigeration, proceeding logically to load calculations, types of equipment most suited to various conditions, and most important, hypothetical and actual examples of how to figure load calculations. It is one book that *shows you "how."*

Profusely illustrated

6 x 9 inches—112 pages

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433 N. Waller Ave. Chicago, Ill.

balance of the evening was spent in playing cards, in which Mrs. Overman was the prize winner.

In the June 17 meeting, Mrs. Overman was appointed Publicity Chairman and Mrs. Seaton Membership Chairman for the coming year.

At the July 1 meeting, there were several visitors present, which helped to swell the total attendance. One new member was welcomed to the Auxiliary. After the business of the evening was completed, the game of rummy occupied the members for the balance of the evening.

KANSAS CITY AUXILIARY

May 14—The meeting was called to order by Mrs. A. M. Hoover, President, and the roll call revealed that ten members were present. After the usual reading of the minutes, paying of dues, and passing of bills, Mrs. Thompson reported sending a card of condolence to Mrs. Anderson during her illness. She also stated that a card would be sent to Mrs. Von Demfange, who had just lost her father.

Mesdames Green, Meeker, and Sullivan were appointed as Entertainment Committee to make arrangements for the next meeting. Mrs. Sullivan was winner of the Bank Night drawing.

During the May 28 meeting a donation of $2 was voted by the Auxiliary to be given the Red Cross fund. The remainder of the evening was spent in entertainment with prizes going to Mesdames Tramposh, Green, and Smith.

On June 1, the ladies were the guests of the men's chapter, during which a tube bending test was the main feature of entertainment.

Harold L. Phillips
California

I have been a subscriber to THE REFRIGERATION SERVICE ENGINEER for several years and would be lost without it. I have received many helpful hints on service and educational pointers in different phases of refrigeration and air conditioning. Your thorough explanations of servicing and rebuilding of hermetic units has been of great value in my work.

AIRO SUPPLY PICNIC DRAWS LARGE CROWD

A LARGE gathering of the refrigeration and air conditioning industry met at the shores of Wisconsin's beautiful Camp Lake July 21 as guests of Airo Supply Company

Views of the soldering contest, sack races, children's races and bingo games which were part of the days activity at the Airo Supply Co., picnic held July 21.

. . ORDERS MEAN *ACTION*

Virginia's *advanced* methods and modern equipment save time for Virginia jobbers and the service men who are their customers.

In Virginia's Modern Tabulating Department

When you buy Virginia, you're sure of *fast*, dependable service.

Why? One reason is Virginia's new roomful of clerical machinery—operated by a trained competent staff who know that time means money—where our customers' orders are concerned.

Buy your KINETIC'S FREON-12* VIA VIRGINIA

*Reg. U. S. Pat. Off.

A POPULAR LINE OF LOW-PRESSURE REFRIGERANTS

EXTRA DRY ESOTOO · V-METH-L · METHYLENE CHLORIDE

VIRGINIA SMELTING COMPANY

At tidewater, **WEST NORFOLK, VIRGINIA**

V VIRGINIA

*"Mills" is the most important name in commercial refrigeration today. Write Mills Novelty Company, 4100 Fullerton Avenue, Chicago, Illinois.

in celebration of its fifth aniversary. Seven hundred fifty men, women, and children representing the service branch of the refrigeration and air conditioning industry enjoyed a day's swimming, fishing, boating, and horseback riding, in addition to a program of games, contests and races. A large public address system with four 60-watt speakers was installed especially for the occasion.

A highlight of the day was a soldering contest conducted by Mueller Brass Company. Competition in this contest was unusually keen as there were only three seconds difference between the time of first, second, and third place winner.

A soft ball game between service men representing Illinois, Wisconsin, and Indiana attracted many. The game was won by the Illinois team, who received five dollars cash, contributed by Chicago-Wilcox Company. The Illinois team was then challenged by a team representing Refrigeration Maintenance Company, Chicago, with a grand prize of fifteen dollars for the winning team. Again the Illinois team was victorious.

Both men and women joined in an attempt to guess the number of fittings contained in a glass jar on display. A beautiful travel clock contributed by Rotary Seal Company was offered as first prize. Many joined in the Bingo game, which was operated continuously throughout the day. Cards were sold for five cents each, and the winner of each game received the entire pot.

Another high spot of the afternoon was the drawing for gate prize, a Parker pen and pencil set contributed by Utilities Engineering Institute of Chicago.

Other contests held during the day were sack races for the adults and foot races for the children. Each winner received a useful prize.

SMALLEST LEAK DETECTED WITH VISOLEAK

OUT of the West comes a product known as Visoleak which has had a rapidly growing demand on the Pacific Coast, and will soon be introduced to the trade throughout the United States. As the name implies, Visoleak is a material which visibly indicates leaks in all parts of a refrigeration system. A definite red color is imparted to the oil and refrigerant in the system, and if there are any leaks they will be indicated by their "bleeding."

Visoleak is being used successfully with all refrigerants, including CO_2, and according to the manufacturer every conceivable test has been made to determine that it is not harmful in any way. Hundreds of large and small plants have been treated during the past two years with complete success, and have proven the material a God-send to users of Freon.

The inventor, Mr. John Waldorf, is one of the oldest men in years of experience in the refrigeration business today. With the advent of Freon he, like many others, sought a positive method of finding leaks and after many disheartening failures his present method took precedence in possibilities. Several years of experimental work was done to perfect methods of compounding the material, and today he is sure that Visoleak will indicate the most "mysterious" leaks, and that there are no objectionable qualities.

Many refrigeration dealers and contractors in Southern California and Arizona have found Visoleak the means of preventing excessive loss of time, refrigerant, and customer satisfaction. Several large operators and numerous engineers specify that treatment with Visoleak be included in all installations of refrigeration equipment for them.

Visoleak is being distributed nationally by the Western Thermal Equipment Co. The 4 oz. size for systems up to 10 lb. refrigerant charge costs $1.00, and the 8 oz. size enough to treat systems up to 40 lb. refrigerant charge costs $2.00. The material is placed in either high or low side, using four ounces, plus one ounce for each 10 lbs. in refrigerant charge.

PACKLESS VALVE MANIFOLDS

HENRY VALVE COMPANY, 1019 N. Spaulding Ave., Chicago, announces a new line of manifolds incorporating the company's Balanced-Action diaphragm packless valves for refrigeration, air conditioning and many industrial requirements.

Manifolds serve a three-fold purpose: 1—A neat, compact, convenient means of mounting shut-off valves. 2—More even distribution of fluid through the various valves and lines. 3—Centralized manual control location.

The outstanding feature of the manifold line is the use of Henry Balanced-Action Diaphragm Packless Valves, the new non-directional valves with the exclusive balancing-action feature that assures positive opening under all pressure conditions. Henry's

Play Safe with "DAY & NIGHT"

"Day & Night" Storage Type Water Coolers are proven units with a time-tested, field-tried record. They are proving their efficiency and trouble-free operation on big and small installations throughout the U. S. and in foreign countries.

Play Safe! Get your copy of the complete "Day & Night" Catalog, showing a complete line of Storage Type Water Coolers for every purpose, with detailed specifications and other useful tables and information.

Cooler Division

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2320 E. 8th ST., LOS ANGELES

WAREHOUSE STOCKS IN PRINCIPAL CITIES

"Dear Diary,"

"Joe hasn't been around for three nights now, he says he's working overtime, I wonder?

★ Lady, Joe ain't kiddin', he's just finding out, like a lot of other service men, that *Herveen* really brings new business into the shop. As the demand for Hermetic servicing increases it becomes more and more profitable for the well-equipped shop to handle this work. That's where we come in, *Herveen* is the replacement gas that enables you to service Meter-Misers.

HERVEEN

brings in business

★ Why not plan to get this profitable extra business for yourself? Refrigeration jobbers all over the country handle *Herveen*, if yours docsn't, write us direct.

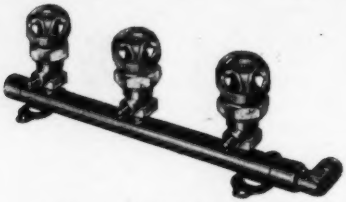
HERVEEN

MODERN GAS CO., Inc.

Manufacturers and Refiners

1084 Bedford Avenue, Brooklyn, N. Y.

oval handwheel, for easier valve operation, is standard on these valves.



HENRY VALVE MANIFOLD.

The angle valves are mounted on the manifold with extruded, reinforced silver soldered joints.

The manifolds are made with from two to six valves, with either flare connections, as shown, or solder connections.

Sizes of valve connections range from ¼ inch to ⅝ inch SAE flare or O.D. solder. Sizes of elbow manifold connection range from ⅜ inch SAE flare to 1⅜ inch O.D. solder.

The company has issued a new bulletin No. 129 which describes these manifolds in detail. A complete description of the valves is contained in the company's bulletin No. 128.

NEW METHYL CHLORIDE DATA

NEW and revised data based on recent investigations of methyl chloride are announced in a new technical book issued by E. I. du Pont de Nemours & Company. It is being distributed by the Chlorine Products Division of The R. & H. Chemicals Dept.

Most of the information concerns the material as a refrigerant, but consideration also is accorded other uses, including applications in chemical synthesis.

Of particular importance, it is explained, are the new and accurate tables of thermodynamic properties, considered to be the only tabulations for methyl chloride sufficiently complete, accurate and consistent for engineering processes. A new Mollier diagram or chart, published for the first time, is based on these thermodynamic data. Viscosity values, just redetermined, together, with the thermodynamic data, made possible the development of new tables of pressure drops of methyl chloride in pipe lines. Likewise, volume displacements and power requirements have been recalculated.

With the large number of refrigerants now available or in use and the changes in code regulations, it was felt desirable to

Ratchet Wrench No. R-70

SPECIALIZED TOOLS for REFRIGERATION WORK

4 WRENCHES IN ONE!

Here's an "every-trip" tool . . . a 4-way time saver on valves, couplings, compressors and other parts that require constant shifting of wrenches to fit different size nuts. One end of the handle has reversible enclosed ratchet with ¼" square opening . . . other end has opening for ¼" and 3/16" square drive and ½" hexagon drive.

This tool is rugged and rigid . . . precision machined for fast, accurate service. Requires only 20° handle swing . . . works easily in cramped spaces. See Snap-on Tools in your phone directory—or write for full information.

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The Choice of Better Mechanics

SNAP-ON TOOLS CORPORATION
Kenosha, Wisconsin

define accurately the field of application for methyl chloride. The book gives information on the more important properties of all of the common refrigerants and includes a pressure-temperature chart showing their relationship. A comparison is made between the theoretically ideal refrigerant and the properties of methyl chloride, a practical refrigerant.

Other sections describe lubrication, copper transfer moisture and drying agents, refrigerant transfer and handling, and the servicing of methyl chloride equipment.

\$ \$ \$

PENN ANNOUNCES LARGE PILOT SOLENOID VALVES

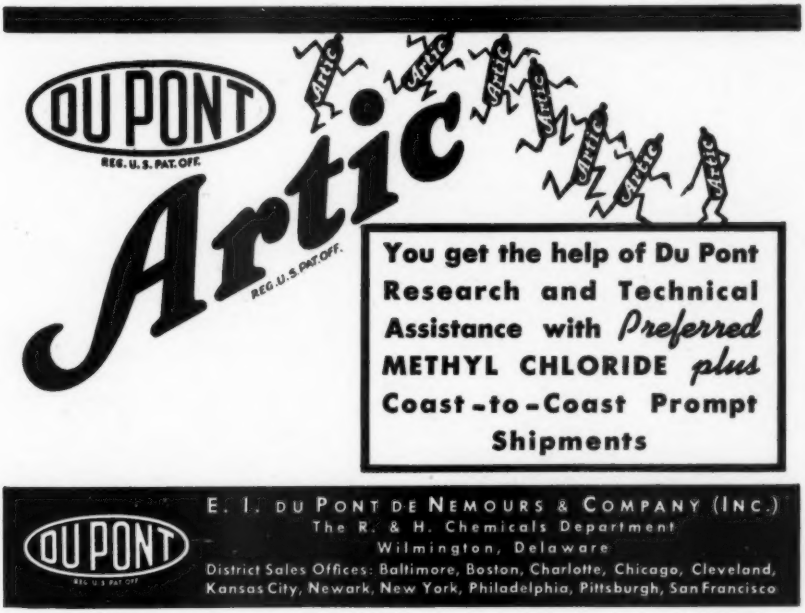
PENN ELECTRIC SWITCH CO., Goshen, Indiana, has just announced the production of solenoid refrigerant valves in sizes to ½ inch and ¾ inch orifice diameter for installations to 45 tons refrigeration on Freon systems, 110 tons on Methyl Chloride systems, and 125 tons on Sulphur Dioxide systems. This new line of refrigerant valves incorporates the principle of pilot valve operation, making possible the use of small coils of low wattage consumption, ideally suited to limited space mounting.

These valves are regularly supplied with ½ inch or ¾ inch female iron pipe tapping, but are also available with sweat connections.

Main and pilot valve needles are of non-magnetic stainless steel, seating in bronze seat insets. The magnetic stainless steel

NEW PENN SOLENOID VALVE.

plunger is of the "floating type," actually remaining suspended in the sealing tube when in the open position. This contruction eliminates the necessity for a kick-off spring and also eliminates the possibility of trouble from residual magnetism.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These pilot operated solenoid valves are regularly supplied without a manual opening rod, but may be had on special order with a sealed manual opening rod which is easily accessible should manual operation ever be necessary. Coils are available for all commercial voltages and frequencies and for A.C. and D.C. service. The valves also may be used for air, oil or water service as well as for refrigeration applications.

UNCLE SAM'S NAVY GETS ICE CREAM

ON land or sea it's "The American Way" to serve ice cream at a soda fountain, and "Uncle Sam's" specifications for warships now include soda fountains and counter ice cream freezers. These are mounted on steel plates, which are fastened to the decks in a manner that permits them to be removed when the decks are cleared for action.

When the U.S.S. "Denebola" was recently reconditioned as a repair ship for the fleet, an eight-foot soda fountain and five-gallon counter ice cream freezer were installed as part of Ship's Service equipment. The "Denebola" is fitted with a machine shop comparable with modern dry dock or land shops and is capable of making most any type of repairs. She is a big ship carrying a complement of 600 men.

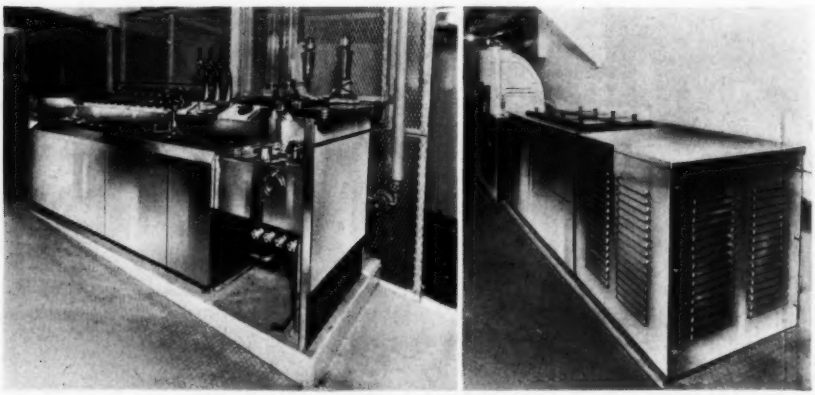
The 40-gallon capacity soda fountain, carbonator, counter freezer and hardening cabinet were built by The Bastian-Blessing Company of Chicago and installed by The Piper Company of Baltimore. This equipment is located on the second deck forward in a special all-tile room. It is operated by the Ship's Supply Officer and all profits are used for the recreational activities of the ship's crew.

BRASS AND COPPER SALES INSTALLS AIR CONDITIONING

FOR the comfort of their employees, customers, and visiting salesmen, the Brass and Copper Sales Company of St. Louis, Missouri, recently installed an air conditioning system in their offices. Another reason for the installation is for display purposes, to show contractors, service men, and prospective customers a system in operation, using equipment sold by the Brass and Copper Sales Company.

The job was installed by the Sodemann Heat and Power Company, air conditioning contractors of St. Louis.

There are many more features incorporated in this job than are installed on the average air conditioner, mainly because the company wished to make the most complete installation possible. The equipment consists of a two speed Par condensing unit, designed for use with an evaporative condenser and installed on the balcony in the warehouse; an Acme Industries evaporative condenser, Superior line shut-off valves, an Acme oil separator, Chicago Metal Hose Vibra-Sorbers, and a large Henry Silica-Gel dehydrator. All these devices were connected through the use of Mueller solder fittings and Type "L" Revere copper tubing.



Two ice cream fixtures installed on the U.S.S. "Denebola," an ice cream fountain at the left and an ice cream freezer and hardening cabinet at the right.

Chieftain

CLEAN UP THAT TOUGH JOB on which you have had so many THANKLESS and PAYLESS CALL BACKS.

A NEW CHIEFTAIN COMPRESSOR or CONDENSING UNIT will make a life-long friend instead of a dissatisfied customer.

TECUMSEH PRODUCTS COMPANY

Factory & Gen. Offices—Tecumseh, Michigan. District Offices: Dallas, Texas; New York; St. Louis, Mo.; Detroit, Mich.; Denver, Colo.; Chicago, Ill.; Los Angeles, Calif.; London, Ontario, Canada; Decatur, Georgia. Export Dept.: Detroit, Michigan.

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1. Destroys Moisture
2. Cures Freezeups
3. Neutralizes Acids
4. Prevents Corrosion
5. Inhibits Copper-plating

Send today for 12 page illustrated Bulletin on Modern Dehydration with Thawzone. Mention distributor's name when writing.

HIGHSIDE CHEMICALS CO.
NEWARK, N. J.

5-WAY ACTION WITH THAWZONE!

Of all dryers on the market, only Thawzone—the liquid chemical dehydrant—offers so many all-around advantages. In addition to its 5-way action, Thawzone is easy and quick to apply. Thawzone is economical—only 1/8 ounce, costing 10c, protects one pound of refrigerant. Thawzone is safe—harms only water and acid. Oil and refrigerant remain substantially pure and undiluted; vital parts are protected. Use Thawzone to cure freezeups, destroy moisture and keep systems chemically dry. Buy it at leading distributors everywhere.

THAWZONE
Fully Protected by U. S. Patents
The PIONEER FLUID DEHYDRANT

The lowside equipment consisted of a McQuay unit complete with air filters, coil, blower, and fan motor. An Alco liquid refrigerant solenoid valve and Sporlan thermostatic expansion valve are used on the McQuay unit. A duct system distributes the cool air to the various private and general offices from the McQuay unit. Recirculated air and fresh air is controlled by dampers.

ALCO VALVE INCREASES ORGANIZATION

A. B. SCHELLENBERG, President of Alco Valve Company, who recently announced the appointment of Richard S. Dawson as Sales Manager, has announced several additions to their sales organization.

Charles C. Allen, formerly with Frigidaire, will have headquarters at Cleveland, Ohio, and will cover their Detroit-Cleveland-Pittsburgh territory.

S. S. Fretz, manufacturer's agent, with headquarters in Jacksonville, Florida, will represent Alco in Florida. Mr. Fretz formerly conducted a refrigeration jobbing business in Jacksonville.

Garrard & Company, 413 Bona Allen Building, Atlanta, Georgia, will represent Alco in Georgia and South Carolina. Walter M. Garrard, the principal of this Company, was formerly connected with York Ice Machinery Corp.

Ben MacDougall, P. O. Box 624, Covington, Louisiana, formerly connected with United Cork Company, will handle the States of Louisiana, Mississippi and Alabama.

GENERAL REFRIGERATION MERGER ANNOUNCED

THE General Refrigeration Corporation of South Beloit, Ill., will henceforth operate as the General Refrigeration Division of Yates-American Machine Company, Beloit, Wis., as the result of a merger voted by stockholders of both companies, effective June 1, 1940.

This announcement will undoubtedly occasion little surprise in the air conditioning and refrigeration industry since it has been

"I WON'T BUY A GAUGE WITHOUT THE RECALIBRATOR!"

THAT has been the attitude of many service men since the RECALIBRATOR feature was incorporated in Marsh Gauges, Thermometers and Recorders. Experience and laboratory tests have shown that when a bourdon-tube instrument is knocked out of adjustment the mere removing and re-setting of the pointer at one point on the scale, does not correct it throughout the entire range. The Marsh RECALIBRATOR gets at the heart of the trouble, however. By simply turning the RECALIBRATOR screw (see illustration) the distortion of the bourdon tube is compensated for and this recalibrates the instrument throughout its entire range. Gauges and dial thermometers with this feature cost little more than the ordinary kind. It is an exclusive Marsh feature.

Compound Gauge

High Pressure Gauge

Ask for the big refrigeration catalog covering this and other Marsh betterments.

JAS. P. MARSH CORPORATION

2059 Southport Avenue Chicago, Ill.

MARSH *Refrigeration Instruments*

GAUGES—THERMOMETERS—RECORDERS—MERCURY SWITCHES

Gilmer BELTS

For
Refrigerators
Oil Burners
Air Conditioners
Washing Machines
Beer Pumps
Water Pumps
Woodworking Tools
Compressors

✓ Gilmer V-Belts fit 6800 models, 153 makes of refrigerators

✓ Gilmer V-Belts are made by belt specialists, on the largest assortment of V-moulds in the world

✓ Gilmer V-Belts are stocked in complete size ranges by Gilmer jobbers everywhere

Write for FREE copy of "America's Belt Bible" and the name of your nearest Gilmer Jobber.

L. H. GILMER COMPANY TACONY, PHILADELPHIA, PA.

DON'T GAMBLE WITH YOUR HEALTH!

Be ready for emergencies, with a

No. 1600 FUMEGARD

Always carry a No. 1600 Fumegard Face Mask and you can go right to work—safely—in any concentration of Sulfur Dioxide, Ammonia or other refrigerants. This husky, compact mask is built for heavy duty service—yet is comfortable, permits easy breathing, full vision and freedom of action. Designed on latest gas mask principles, the No. 1600 Fumegard provides excellent protection and utmost serviceability. Order a No. 1600 Fumegard today. Furnished complete with carrying case and one extra refill.

● **WRITE FOR NEW BOOKLET** *showing Masks, Respirators and other safety data for refrigeration engineers.*

PULMOSAN SAFETY EQUIP. CORP.
Dept. RS, 176 JOHNSON ST. BROOKLYN, N. Y.

$10.00 F.O.B. Brooklyn, N. Y.

Postage prepaid in U. S. if payment accompanies your order.

rather generally known throughout the trade that the principal officers and directors of the General Refrigeration Corp., also occupied similar positions with the Yates-American Machine Co., and that there was common ownership of a large percentage of the outstanding securities of both companies.

Consequently, Alvin Haas, Vice-President and General Manager, points out, this merger will have little or no effect upon company policies or plant operations. In addition to the General Refrigeration plant at South Beloit, Ill., where manufacturing operations are continuing as usual, the modern and completely equipped plants of the Yates-American Machine Co., at Beloit, Wis., and Hamilton, Ontario, Canada, are now available to the General Refrigeration Division, as are their research laboratories and their trained and experienced personnel. These manufacturing advantages will result in far-reaching operating economies and efficiencies, Mr. Haas stated, and will place the company in an exceedingly favorable position in the industry.

NEW CATALOGS AND BULLETINS

Hasco, Inc., Greensboro, North Carolina, has combined their two catalogs into one big book. We believe that every serviceman will be interested in this catalog as it contains more actual compressor replacement parts than any catalog issued before. It contains replacement parts for Chieftain, Copeland, Brunner, General Electric, Frigidaire, Kelvinator, Servel, Universal and others, each part is illustrated and described with specifications. Standard parts such as Ranco Controls, Detroit Expansion Valves, Dayton belts and other makes are also illustrated and described. In the back of the catalog Hasco illustrates and prices the exchange price on discharge valves, water valves, float valves and many other parts that means a considerable saving for the service man. All prices are list prices and subject to a substantial discount to the trade.

If you would like a copy of this catalog for your file, write Hasco, Inc., direct. A business card enclosed with your request will help us to identify you with the trade.

Miller
REPLACEMENT DOOR GASKETS
"Fit Like the Paper on the Wall"
● That's because each Miller Replacement Gasket is made from the same die which produced the original gasket for the refrigerator manufacturer. There's no variance in quality, either. Here again the "original" formula for age and grease-resisting compounds is employed to give you the finest rubber door gaskets money can buy.
The Miller line is complete, offering 34 gasket types with which you can service 80% of all refrigerators regardless of make. If you want to put door gasket replacements on a profitable, business-like basis, write for free sample card and name of nearest Miller jobber.
MILLER RUBBER CO., INC. • AKRON, OHIO
"Engineers in Rubber"